



**KILL CREEK WRRF RFP Proposal
Recycled Water System**

**Project WW2001
Gardner, KS**

Grundfos HydroMPC Primary & Alternate Options

MANUFACTURER'S REP.:

**HAYNES EQUIPMENT COMPANY, INC
15725 PFLUMM ROAD
OLATHE, KS 66062**

March 2, 2021



15725 Pflumm Road
Olathe, Kansas 66062
Phone: 913-782-4962
Cell: 913-481-7358
Web: www.haynesequip.com
Email: ssorenson@haynesequip.com

March 2, 2021

ATTENTION: City of Gardner, KS

REFERENCE: KILL CREEK WRRF
UV Disinfection and Recycled Water Systems
Project WW2001

RFP DUE DATE: March 2, 2021 at 12:00 pm

Dear Ladies and Gentlemen:

Haynes Equipment Company, Inc. is pleased to offer the following equipment on the above referenced project. For your consideration our quotation is as follows:

EQUIPMENT	DESCRIPTION	MFR.
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UV	OPTION 1: Chambered System for 9 MGD	GLASCO UV
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- Two (2) IL-BT-9500-16-AW reactors with 304 SS elbows.
 - Automatic cleaning center with compressor, regulator and dryer.
- One (1) shared System Control Center/Ballast control center with Allen Bradley PLC for alarming, dimming and other functions.
 - System's operator user interface is a 11" Rohtek Color touch.
 - Control Center to be installed on ground level of UV building.
 - UV intensity monitoring, lamps status LEDs, and running time meter. One (1) transformer.
- Design layout approved by plant personnel; effluent pipe to be cut back to 1' from wall BY OTHERS.
- Freight and Startup Services included.
- See Chambered Proposal Package for all of the details.

TOTAL Glasco Chambered Option: \$ 210,000

UV	OPTION 2: NONCON System for 9 MGD	GLASCO UV
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- Two (2) NONCON reactors with internal heat management system. Cooling pumps will be supplied. One cooling system per bank.

- One (1) Bank - each bank having eight (8) UV modules – each holding eleven (11) lamps. Eighty-eight (88) lamps. Sixty (60) tubes will extend through reactor.
- One (1) Ballast Control Center (BCC) NEMA 4X modified Type 304 SS free standing enclosure. Includes LEDs, Run Time and UV monitoring system.
- One (1) System Control Center Allen Bradley PLC for alarming, bank pacing and other functions. System's operator user interface is a 11" Rohtek Color touch. One (1) transformer.
- Layout/Design approved by plant personnel. North staircase (facing east) needs to be moved 90 degrees to face north. BY OTHERS.
- Freight and Startup Services/Training Included.
- See NONCON Proposal Package for all of the details.

TOTAL Glasco NONCON Option: \$ 259,750

**RECYCLED
WATER PUMP
STATION**

PRIMARY OPTION: CRE Pumps with MLE Motors/Integrated VFDs

GRUNDFOS

- (1) HydroMPC-E system for 475 GPM @ 100 psi to replace the existing recycled water system
 - (2) CRE-45-3-1 pumps which include integrated VFD on each 25 hp motor, 460/60/3
 - See attached datasheet and page 3/10 in the HydroMPC-E specification for more information on integrated VFDs.
 - Control Panel includes the CU352 Pump Controller specifically designed to control parallel operation of multiple pumps
 - See detailed RFP requirements, installs, datasheets, proposal, specification and IOM manuals attached

TOTAL Grundfos Primary Option (no adders) HydroMPC-E 2CRE-45: \$ 45,779

**RECYCLED
WATER PUMP
STATION**

ALTERNATE OPTION: CRE Pumps with Panel Mounted VFDs

GRUNDFOS

- (1) HydroMPC-EC system for 475 GPM @ 100 psi to replace the existing recycled water system
 - (2) CR-45-3-1 pumps with standard 25 hp motors, 460/60/3
 - Panel mounted VFD which is the Grundfos CUE
 - See datasheet and page 3/11 in the HydroMPC-E CR specification for more information on the CUE, panel mounted VFD.
 - Control Panel also includes the CU352 Pump Controller specifically designed to control parallel operation of multiple pumps
 - See detailed RFP requirements, installs, datasheets, proposal, specification and IOM manuals attached

TOTAL Grundfos Alternate Option (no adders) HydroMPC-EC 2CR-45: \$ 57,830

Recycled Water Pump Station Notes:

- **WARRANTY:** 24 months from start-up of equipment, or 30 months from shipment, whichever is sooner.
- Freight included.
- Haynes Equipment startup and training included.
- Piping will be needed to connect discharge to current discharge – BY OTHERS.
- Existing base can be reused if desired.
- The manifold ISOs and mechanical couplings are by others.
- There are options for dry run protection in the panel settings using different sensors or switches, but that feature can only accept one Digital or Analog Input to turn the system on/off when inlet pressure or water level is low.
- The panels use fuses, not circuit breakers. This is a UL requirement for panels with the given VFD and at the given SCCR.
- The panel options include surge arrestors, but lightning arrestors are not available.
- Panels are Fan-cooled. There is No Heat Exchange or A/C included.
- No PRV or tap for one included.
- The MLE is nameplated for 480V +/-10% (UL listing), which falls short of 550V on the original spec.
- The MLE system options does not and cannot include VFD Bypass switches. line reactors, or additional custom options on the alternative CUE system selection.
- Some features on the panel based on the old spec are accessed through the controller settings (e.g. HOA, elapsed time, etc).
- Phase/voltage monitor is on main power supply, not each pump.

Thank you for your consideration of Grundfos recycled water skid as well as the Glasco UV system.

Sincerely,



Shawna Sorenson, Haynes Equipment Co.

GRUNDFOS – Recycled Water System

Table of Contents

Project Location:
Gardner, KS

Manufacturer's Rep:
Haynes Equipment Co.

	Introductory Documents <ul style="list-style-type: none">• Gardner RFP Requirements• HydroMPC Brochure• Haynes Installs with photos
1	Primary Option <ul style="list-style-type: none">• HydroMPC-E 2CRE45-3-1• VFDs Integral to MLE Motors
2	Alternate Option <ul style="list-style-type: none">• HydroMPC-EC 2CR45-3-1• Panel Mounted VFDs
3	Additional Accessories – Both Options <ul style="list-style-type: none">• Boiler Drain• MAG Meter• Diaphragm Pump
4	Parts <ul style="list-style-type: none">• CR45 Pump Only• MLE Parts
5	Manuals <ul style="list-style-type: none">• CRE Pump• HydroMPC system• CR Pump• CUE VFD (Panel Mounted)

Grundfos / Haynes Package Proposal - Recycled Water System



PROPOSAL REQUIREMENTS

KILL CREEK WATER RESOURCE RECOVERY FACILITY UV Disinfection and Recycled Water Systems Project WW2001

Vendor's Proposals shall include all the separate sections identified in the following Sections Requirements. Partial or incomplete submittals or submittals with responses in an order that does not match that presented in the Section Descriptions below may result in disqualification.

Section 1. Experience and Qualifications

Describe the experience and qualification of the Vendor to include:

1. Number of years the Vendor has been in business.
 - i. Through 83 companies Grundfos is directly accessible in 56 countries, and through our network of partners, distributors and subdealers, we are present in even more. The company employs around 19,700 people today. Poul Due Jensen founded the company in 1945 from his basement in Bjerringbro, Denmark. The first pump made was a water pump. Through the decades, we have sharpened our skills, and to this day, we take pride in moving water to where it should be. Using as little energy as possible when doing it.
2. Listing of manufacturing facilities for equipment proposed for this project, the location of these manufacturing facilities, and years in operation.
 - i. Fresno, CA
3. Sales for the model of equipment proposed for the past five fiscal years.
 - i. Just for Haynes Equipment in 2020 Grundfos HydroMPC sales were \$247,000.

Section 2. Description of Equipment Proposed – See detailed Grundfos proposal attached.

Describe, through use of technical drawings and technical literature, how the proposed equipment meets or exceeds the currently installed system requirements. The Vendor shall include a description of all auxiliary or support equipment and any warranties and services provided by Vendor.

The Vendor shall provide in summary of proposed equipment a general arrangement drawing for the City showing proposed layout for equipment systems, modules, AND ancillary equipment including ballast enclosures, power and light panels, HMI's, and any other control or electrical equipment recommended.

The following items shall be included but not limited in the equipment description summary and general arrangement drawings: **Not applicable for Grundfos Pump Station**

- ii. Model number of UV equipment,
- iii. System peak capacity in MGD,
- iv. Number of UV lamps,
- v. Power consumption calculations for the proposed equipment,
- vi. Panel and enclosure dimensions,
- vii. Electrical room dimensions and enclosure spacing
- viii. Calculations demonstrating the proposed equipment provides the UV doses as required for disinfection.

- ix. Calculations showing head loss through UV modules under design peak flow conditions.

Section 3. Experience with Installed Equipment – [See install list attached](#)

Provide the following data on at least five similar installations by Vendor of the equipment type or model proposed with the following minimum information. At least five installations shall be located in the United States and shall have at minimum, the same number of lamps as proposed for the City and shall have been in service over two years. Additional installations may be submitted, and the equipment installed at the other referenced installations should be of similar size and in a similar application to that proposed for the Kill Creek Wastewater Resource Recovery Facility.

1. Plant Name/Location/Owner
2. Owner's current contact person and phone number
3. Date Installed or commissioned
4. Upstream treatment processes (i.e., primary, activated sludge, filtered, etc..)
5. Approximate hours run on equipment since installation
6. Disinfection performance obtained
7. Corrective maintenance history (warranty repairs, parts replaced under warranty, parts purchased from manufacturer after warranty)

Section 4. Preventive Maintenance Requirements – [See Grundfos IOM Manuals attached](#)

Provide a tabulation of preventive maintenance requirements that includes for each task:

1. Task description,
2. Frequency of task,
3. Estimated staff hours to perform the task,
4. Equipment, materials, and tools required to perform the task.

Tabulation should be from Manufacturer's standard literature.

Section 5. Service and Parts Facilities, and Service Staff

1. Provide if the service technicians full-time employees of the Vendor or contract services.
 - i. [Full-Time Haynes Equipment employees](#)
2. Provide the normal response time for on-site services from the time of order to the arrival of a service technician.
 - i. [If a true emergency, Haynes could be there the same day](#)
 - ii. [If urgent Haynes can be there within 1-2 days](#)
 - iii. [Non-urgent service Haynes needs 2 weeks to schedule](#)
3. List the locations of the Manufacturer's service facilities in the United States.
 - i. [Haynes Equipment, Olathe, KS](#)
4. List the parts-stocking warehouse locations in the United States.
 - i. Are all parts for the proposed equipment type or model available at these locations?
 - [Yes, Fresno, CA and also Allentown, PA, Brookshire, TX and Memphis, TN](#)
5. Provide the normal lead time for delivery of parts from time of order.

Primary System Complete spare pump: 98879638; CRE45-3-1 A-G-A-E-HQQE 3x460 60 HZ, \$17,800, 2-3 weeks AEO

Alternative System Complete spare pump: 99918129; CR45-3-1 A-G-A-E-HQQE 3x230/460 60 HZ (Alternative system selection), \$12,811, 2-3 weeks AEO

5-years of pump operation recommended spares:

96416932; Kit, Chamber stack CR (or CRE) 45-3-1, \$3,815, 1-2 weeks AEO

96525458; Kit, shaft seal CR/N 32/45/64/90 HQQE, \$500, 3-4 business days AEO

96416599; Kit, gaskets CR(N)45/64 1-10 EPDM, \$170, 3-4 business days AEO

MLE motor spares & Service tool (Primary System): 91150033; MLE160AC 3X480V-2 25HP F C9-S with pkg, \$8,920, 1-2 week AEO (complete MLE motor & VFD)
96796812; Kit, Ball Bearing 7310.BE/6310.Z.C4, \$181, 3-4 business days AEO
98046408; MI301 (IR Trans, Universal-Blue Tooth), \$550, 4-5 business days AEO (service tool to use Grundfos GO app)

Provide a detailed list of spare parts included in the Vendor's proposal.

- i. Include current list price for each spare part sold by Vendor.
 - [See above](#)

Section 6. Schedule of Prices

1. Attach completely, "Schedule of Prices" for proposed equipment, included spare parts, and services provided in Vendor's proposal.
 - [See attached](#)
2. Provide a formal "Quotation" complete with a detailed scope of services and all terms and conditions suitable for giving to a bidding contractor for the installation construction contract. This shall include initial equipment costs, guaranteed power consumption at design average conditions, and guaranteed costs for replacement lamps, ballasts, and intensity sensors. Vendor shall guarantee purchase price for lamps, ballasts, and intensity sensors for **five (5)** years following the date of Substantial Completion of the equipment installation construction contract.
 - [Pump parts can only be guaranteed for the current calendar year.](#)
3. The Vendor is hereby notified that the "Schedule of Prices" will be made available to all bidding installation contractors who request them if the Vendor selected.

Section 7. Start-up and Training

1. Provide start-up and training plans including minimum number and duration of startup, testing, and training sessions and number of technicians per visit. Training plan should include description of training including methods of instruction and sample handouts, presentations or reference material.
 - [\(1\) Haynes service tech for 1 trip, 1 day.](#)
 - [Hands on training at pump station for up to 2 hours.](#)
 - [Training in classroom if desired for up to 2 hours.](#)

Schedule of Prices

	Primary Option - HydroMPC-E with (2) CRE-45-3-1 pumps with integrated VFD in motor	Alternate Option - HydroMPC-EC with (2) CR45 pumps & panel mounted VFDs
Pump System	\$43,179.00	\$54,800.00
Estimated Freight	\$1,400.00	\$1,830.00
Haynes Startup Services	\$1,200.00	\$1,200.00
TOTAL NO ADDERS:	\$45,779.00	\$57,830.00
ADDER: Diaphragm Tank for low flows	\$1,875.00	\$1,875.00
ADDER: 6" MAG Meter and Transmitter	\$4,495.00	\$4,495.00
Spare Part Options:		
Complete Pump	\$17,800.00	\$12,811.00
Stack Kit (same for either option)	\$3,815.00	\$3,815.00
Kit, Shaft Seal	\$500.00	\$500.00
Kit, Gaskets	\$170.00	\$170.00
Complete CRE45 motor and VFD	\$8,920.00	NA
CRE45 Motor	NA	NA
CRE45 VFD	\$3,456.00	NA
CR45 Motor	NA	\$3,928.00
CR45 VFD in panel	NA	\$4,100.00
Kit, Ball Bearing	\$181.00	\$181.00
Service tool for Grundfos GO App (Haynes has one that can be used for service calls)	\$550.00	\$550.00

BoosterpaQ®

Hydro MPC Controlled Booster Systems



Superior boosting with Grundfos BoosterpaQ

A Grundfos BoosterpaQ system fitted with Grundfos CRE – frequency converter-controlled pumps – ensures complete and instant control, optimum flexibility of booster output, and unbeatable efficiency.



Grundfos BoosterpaQ systems are manufactured to the highest standards in the industry. Our MPC controllers can handle even the most difficult boosting applications with ease and accuracy.

COMMITTED TO QUALITY

Commitment to quality is evident in every aspect of our BoosterpaQ systems. Based on the extremely reliable, high-efficiency CR pump range, BoosterpaQ solutions are fully integrated systems. Each component is made by Grundfos to meet the strictest quality requirements, so you can rest assured that all technologies involved in the process work perfectly together.

BOOSTERPAQ FEATURES

- › Outstanding reliability
- › High efficiency
- › Fully integrated, all-in-one systems
- › Systems to match every need and requirement
- › Easy installation and operation
- › Technology based on decades of know-how and experience

Grundfos CR pumps – state-of-the-art reliability and efficiency

Grundfos BoosterpaQ systems are based on the world-renowned CR range of multistage centrifugal pumps. Grundfos was the first to develop this pump type nearly 40 years ago, and the current generation of CR pumps remains unchallenged as the world's best. With their history of outstanding reliability and efficiency, CR pumps provide the best foundation for our booster systems.

BoosterpaQ systems equipped with intelligent CRE pumps offer an even higher rate of efficiency as well as reduced energy costs. CRE pumps are equipped with an integrated variable-frequency drive motor. The end result is complete control, optimum flexibility of booster output, and unbeatable efficiency at all times.

THE COMPLETE SOLUTION

All components have been combined with focus on quality and efficiency. Grundfos BoosterpaQ systems are designed to last: sturdy, compact units with easy access to all service parts.



The Grundfos CR/CRE pumps have been engineered for maximum efficiency and reliability. These advantages are incorporated into Grundfos BoosterpaQ systems.



The Grundfos Hydro MPC booster system ensures proper and constant water pressure at all times.

Grundfos BoosterpaQ systems can be used wherever additional pressure is needed. Each booster model has been designed to meet the customer's specific needs and requirements for capacity and control.

WATER SUPPLY

Our BoosterpaQ systems are ideal for water supply systems and pressure boosting in multi-story buildings, which can vary significantly throughout the day. These situations can place extraordinary demands on the equipment used. Grundfos booster systems make it easy to provide optimum comfort for the user by maintaining constant water pressure at all levels and at all times.

› Industry

Industries can benefit greatly from using a Grundfos booster solution. If you require constant pressure in the face of highly variable flows, we have the solution. Even the most demanding applications will benefit from the accuracy and advanced pump control offered by our BoosterpaQ systems.

› Irrigation

Grundfos BoosterpaQ systems can help conserve water and optimize crop yields by responding to pre-set minimum and maximum levels. BoosterpaQ systems go easy on piping networks in golf course irrigation systems and adapt performance automatically to any number of sprinklers at any pressure zone during the irrigation cycle. Benefits like these are what make Grundfos BoosterpaQ systems the perfect choice for your irrigation systems.

The Multi-Pump Control – MPC

THE “BRAINS” OF THE SYSTEM

The newly developed, highly advanced MPC control unit is the “brain” behind our BoosterpaQ systems. Specially designed for Grundfos boosters, the MPC is easy to operate and monitor.

The primary task of the MPC unit is to control the number of pumps in operation, as well as the speed of the individual pumps, in order to adjust the performance of the system to variations in demand. The MPC controller is capable of controlling up to six pumps connected in parallel.

Grundfos has used its experience with pump system controls to design the operation platform and control functions of the MPC to suit a wide range of application types.

The result is a highly advanced control system that offers multiple features and functions that can be used to improve the performance of the booster system while maintaining a user-friendly operator interface.

INSTALLATION WIZARD GETS YOU STARTED

Correct installation and commissioning of any booster system is a prerequisite for attaining optimum performance of the system and trouble-free operation.

Grundfos created an installation wizard to make it simple and straightforward to operate the BoosterpaQ. The installation wizard guides the operator through a sequence of instructions to ensure that all settings are made in the correct order and that system performance, as well as required protection settings (e.g. water-shortage protection), are set up step by step.

USER-FRIENDLY INTERFACE

Because ease of use was a top priority when developing the MPC controller, Grundfos designed a user interface that offers a wide range of features and functions that make operating the device intuitively simple.

- Large, backlit graphic display screen with overview of the system, including key measuring points
- Menu bar for easy navigation

- System information and status
- Control functions
- Cascade control
- Alternation
- Speed control
- Help function for each screen

DATA COMMUNICATION

The MPC is set up for various communication systems to help you monitor and control the unit from a distance.

- BUS communication
- Ethernet via built-in web server
- Grundfos GENI Bus for interface with other Grundfos products

Via the Ethernet connection, the Grundfos BoosterpaQ system can be operated from a remote computer where

Step-by-step installation guide

9/15 - Water shortage monitoring device

Select what kind of water shortage monitoring device has been mounted and press the [ok] button to store.

Then select "go to next page" and press the [ok] button.

See the wiring diagram for details about the terminals.

Go to next page →

Pressure transmitter at terminal no. 54 ☐

Pressure switch or float switch at terminal no. 12 ☐

2005-08-29 19:07

The Hydro MPC control unit features an installation wizard, which guides the user through a series of dialogue boxes on its large graphic display screen.



The Hydro MPC control unit offers maximum user friendliness with a large graphic display screen and menu bar for easy navigation.

the user will be able to view the control panel on their computer screen. This allows you to operate the booster system as easily as if you were standing in front of the actual control panel.

Remote monitoring and data acquisition is also possible. Status on individual pump and system levels, as well as operating conditions, settings, control mode, warnings, and alarms can be read out from a remote computer.

LOG AND STATISTICS

For full optimization of the booster system, it's important to ensure that valid operation data is obtained and continuously logged. The Grundfos MPC control offers easy access to a wide range of operating data and statistics, such as:

- System performance
- Energy consumption
- Alarm and warning log

Reliability, efficiency and adaptability

Grundfos boosters represent reliability, efficiency, and adaptability. Our boosters are the obvious choice for any application: they're built to last and feature a wide range of user benefits.

TRIED AND TESTED

At Grundfos, there are no compromises when it comes to quality. We use only the best materials and state-of-the-art technologies, so you can have every confidence in the finished product. All components, as well as the finished product, have been carefully tried and tested before leaving the factory.

EFFICIENCY YOU CAN COUNT ON

Constant pressure at all levels is a vital feature of any booster system, whether it's installed in a multi-story building or in any industrial application. Grundfos booster systems offer constant-pressure control and can handle all

variations in water consumption. Harmful peak pressures are avoided, which means less stress on the piping network and reduced water loss in the distribution circuit as less water is forced through leakages.

FULLY ADAPTABLE TO YOUR APPLICATION

Grundfos BoosterpaQ systems adapt to variations in demand at all levels and at any time. Whether in residential buildings or in industrial applications, a Grundfos booster system is capable of maintaining pre-set constant-pressure or required water or temperature levels. This capability prevents undesirable fluctuations and keeps energy consumption at the lowest level possible while reducing wear and tear on pipes and valves.

Grundfos BoosterpaQ systems offer constant-pressure control.



1



Loss of efficiency has been reduced to a minimum in the impeller stack of the Grundfos CR pumps. A floating seal ring has been applied as a perfect seal between the individual chambers.

2



An enhanced impeller/chamber design ensures a more streamlined flow. Tiny margins determine the success of the final result, so Grundfos developed a highly specialized, laser-welding technology in order to achieve the highest efficiency on the market for any multi-stage centrifugal pump.

Innovative technology

Only long-term savings are real savings, and Grundfos BoosterpaQ systems are created with this in mind. They combine innovative technology, exact capacity adjustment, low maintenance, and many other features that help to significantly reduce the total cost of owning a booster system over its lifetime.

PUMP TECHNOLOGY FOR SUPERIOR EFFICIENCY

At the heart of every Grundfos booster system you'll find a Grundfos CR or CRE pump. Decades of engineering experience have been applied to take the efficiency and reliability of these pumps to the highest level.

SUBSTANTIAL SAVINGS ON ENERGY COSTS

On average, the Grundfos CR pump models offer higher pump efficiency compared to any other multi-stage centrifugal pump on the market, which translates into energy savings for every CR pump. When pumps are in operation for several hours each day, improvements such as these provide substantial savings on energy costs year in and year out.

FAST AND EASY MAINTENANCE

The CR pumps used in Grundfos BoosterpaQ systems incorporate many features that make maintenance work easy and fast, thereby saving you time and money. For example, the patented shaft seal is remarkably durable and can be replaced in a matter of minutes and without the use of special tools.

Similar care and consideration has gone into the overall design of the entire system in order to make our boosters easy to install and service-friendly. Over time, this adds up to a substantial savings for you.

Unmatched reliability

BoosterpaQ systems are based on the Grundfos CR range of multi-stage centrifugal pumps, which offer efficiencies that are higher than any of our competitors models. This superior efficiency has been achieved through a unique hydraulic design that incorporates laser-welded impellers.

In addition, the Grundfos CR pumps are fitted with one of the industry's most reliable shaft seals, durable internal bearings, and most advanced rotating assembly available on the market today.

GRUNDFOS MOTOR: A PERFECT MATCH FOR YOUR BOOSTERPAQ

Grundfos manufactures its own three-phase motors (up to 10 hp) to ensure maximum performance. Grundfos ML motors are remarkably silent and highly efficient.

EASY-TO-REPLACE CARTRIDGE SEAL

CR pumps are fitted with a specially designed cartridge seal that increases reliability and enables easy access and quick service. For pumps with heavy motors (>10 hp), shaft seal replacement is possible without removing the motor.

SELECT YOUR PREFERRED MATERIAL

The CR is available in three different materials: stainless steel AISI 316, stainless steel AISI 304, and AISI 304/cast iron so you can choose a solution that best meets your needs. The CR's bearings are extremely durable, made of hardwearing materials, and offer options for handling difficult liquids.

The quality of our equipment and the sophisticated, user-friendly MPC control unit will supply you with the pressure you need, when you need it. So don't sweat the details: let our pumps do the work for you.

Grundfos CR pumps are available in three different materials: stainless steel AISI 316 or AISI 304, and an AISI 304/cast-iron combination for the handling of various types of media.





Find what you need

Depending on how complex the actual situation is, you can choose from our standard range, mix components to create a customized solution, or have us create an entirely unique booster system almost from scratch.

Grundfos BoosterpaQ systems are available in various configurations to ensure that there's a model available for every conceivable application and to meet your specific requirements. The end result is a product range with an unparalleled degree of flexibility.

PRE-DEFINED SYSTEMS OR CUSTOMIZED SOLUTIONS?

The predefined range is comprised of our most popular BoosterpaQ models – and each one is exceptional in its own right.

Grundfos takes a unique mix-and-match approach to customized solutions: all the elements that make up a Grundfos booster system can be seen as modules which can be combined in countless ways to create the solution that is exactly right for the application at hand.

By combining the number and type of pumps, motor size, shaft seal materials, pump materials, control features, etc., it is possible to put together a booster system that fully matches the actual requirements of nearly all applications, regardless of the circumstances.

In the case of highly specific needs that cannot be met by our pre-defined range or customized solutions, which combine existing components, let us know. Our skilled team of engineers are available to create a solution unique to your application.

Standard or customized solution? Our skilled team of engineers would be more than happy to assist you.



Grundfos CR pumps are equipped with a unique, easy-to-replace cartridge shaft seal that's available in a choice of materials. It can handle temperatures from -40°F to 250°F (consult factory for complete booster systems when the operating temperature is greater than 176° F).

Grundfos boosters – in a class of their own

Grundfos is one of the world's leading manufacturers of pumps and pumping systems and was the first company ever to develop a multistage in-line centrifugal pump. The current CR pump series remains second to none in terms of efficiency, reliability, and long-term operation costs.

These superior product features characterize the Grundfos range of BoosterpaQ systems and contribute to making Grundfos boosters the unrivaled market leaders, whether for commercial building projects or industrial applications.

Grundfos BoosterpaQ systems are fully integrated systems made to the very highest standards. The advanced MPC controller features a user-friendly interface, making these boosters capable of handling the most difficult jobs with ease and accuracy.

U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: (913) 227-3400
Telefax: (913) 227-3500

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: (905) 829-9533
Telefax: (905) 829-9512

Mexico
Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. Mexico
Phone: 011-52-81-8144 4000
Telefax: 011-52-81-8144 4010



L-BPQ-SL-001 04/07 (US)
Subject to alterations

Haynes Installs for Grundfos HydroMPC / CR Type Pumps

Mitchell County RWD#3, KS – 3/16/20 – 2CRE45-1-1



Oak Grove, MO – 3/25/20 – 2CRE10-4, 3hp



Salina, KS – 1/28/20 – HydroMPC-EC with 3CR5-13, 5hp



Lake Winnebago, MO – 10/29/19 - 2CRE 45-3-2 and 1CR1



Chanute, KS – 3/22/17 - HydroMPC-E with 4CRE45-1 10HP



Hiawatha, KS – 11/3/17 - HydroMPC-E with 3CR90-3 50HP



City of Emporia, KS – 2/6/20 – HydroMPC-E with 3CRE10-6

Linwood, KS – Suburban Water – 2/7/20 – HydroMPC-E with 4CR64-1-1

Bate City, MO – 3/25/20 – HydroMPC-E with 3CRE10-4

Sedalia, MO – 5/12/20 – HydroMPC-E with 2CR64-3

TAB1 - BoosterpaQ Information

**Gardner, KS - Quote
Primary Selection**

**HYDRO MPC E
2CRE45-3 with
Integrated VFDs**

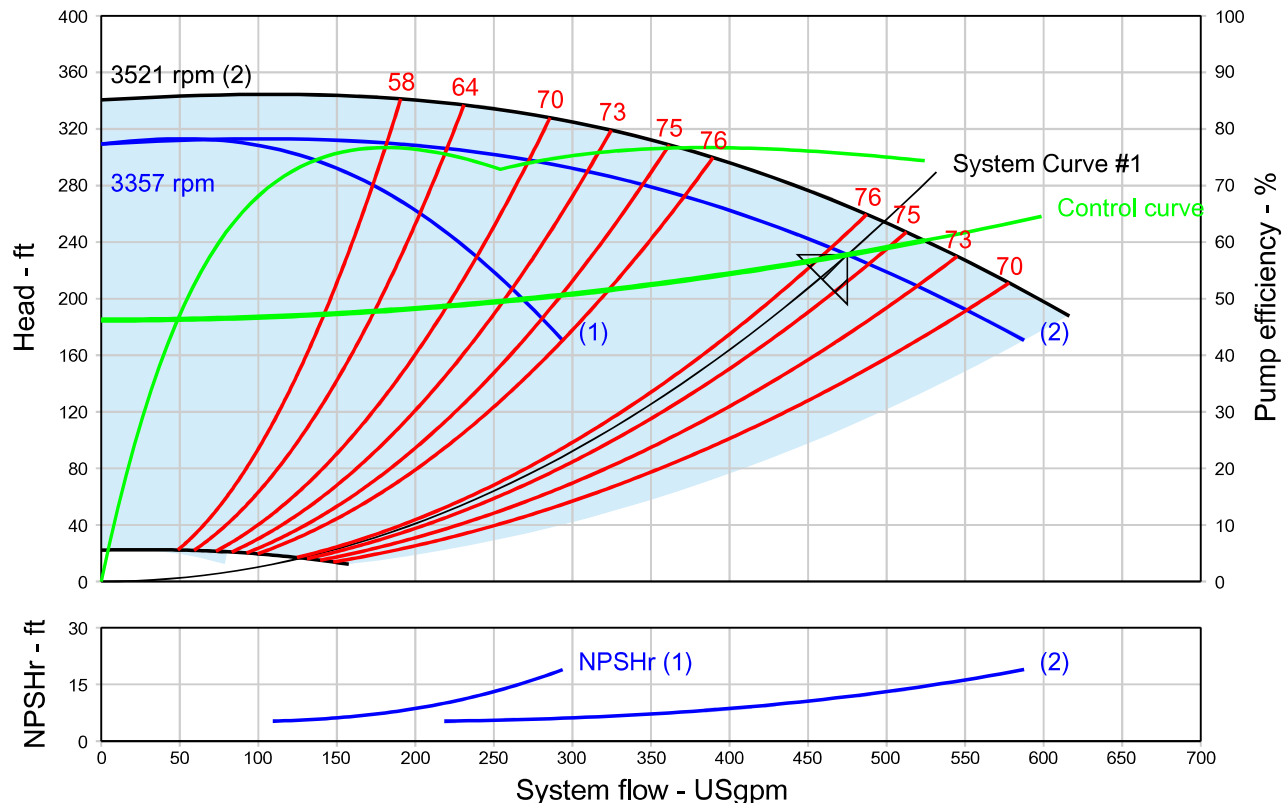
TAB 1

BoosterpaQ Information

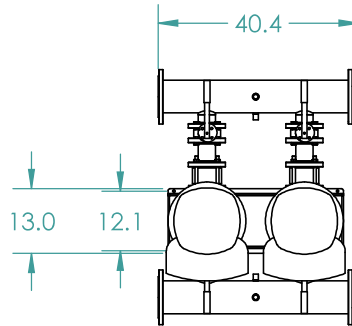
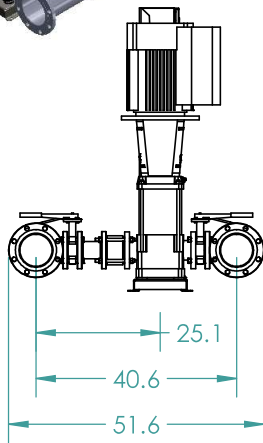
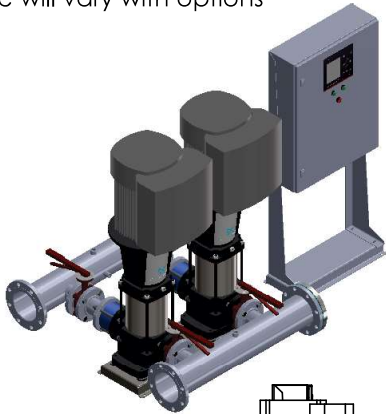
Pump Performance Datasheet

Customer	:	Quote Number / ID	: 5332528402
Customer ref. / PO	:	Model	: Hydro MPC-E 2CRE 45-3-1 3x460V
Tag Number	: 001		60Hz
Service	:	Part Number	: Custom system
Quantity	: 1	Stages	: 3
Quantity of pumps	: 2 active + 0 standby	Based on curve number	: RC10199_SB Rev 0
		Date last saved	: 02/26/2021 2:21 PM

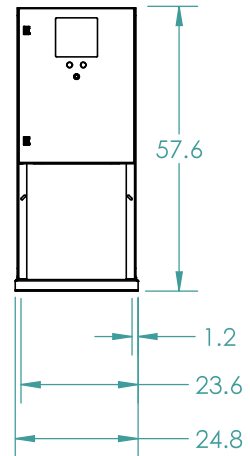
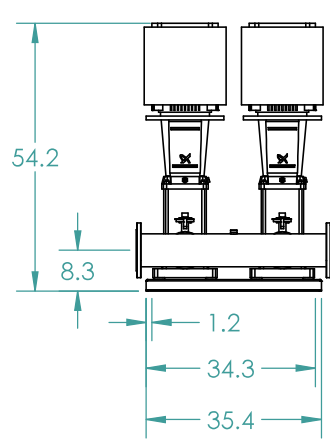
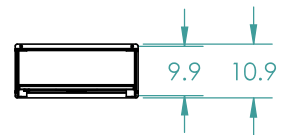
Operating Conditions		Liquid	
System flowrate	: 475.0 USgpm	Liquid type	: Cold Water
Flowrate per pump	: 237.5 USgpm	Additional liquid description	:
Differential head / pressure, rated (requested)	: 231.1 ft	Temperature, max	: 68.00 deg F
Differential head / pressure, rated (actual)	: 231.2 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
Suction pressure, min / max	: 10.00 / 10.00 psi.g	Viscosity, rated	: 1.00 cP
NPSH available, rated	: Ample	Vapor pressure, rated	: 0.34 psi.a
Site Supply Frequency	: 60 Hz	Material	
Power Supply	: 3ph 460V	Material selected	: Standard - Cast Iron / 304 Stainless Steel
Performance		Pressure Data	
Speed, rated	: 3357 rpm	Pump shut off pressure	: 145.5 psi.g
Speed, maximum	: 3521 rpm	Maximum allowable suction pressure	: 145.0 psi.g
Speed, minimum	: 900 rpm	Driver & Power Data (@Max density)	
Pump efficiency	: 75.62 %	Motor sizing specification	: Max power (non-overloading)
NPSH required / margin required	: 11.77 / 0.00 ft	Margin over specification	: 0.00 %
Ns (imp. eye flow) / Nss (imp. eye flow)	: 1,733 / 9,116 US Units	Service factor	: 1.00
Head maximum, rated speed	: 313.0 ft	Rated power (based on duty point)	: 2 x 18.32 hp
Head rise to shutoff	: 33.88 %	Max power (non-overloading)	: 2 x 19.44 hp
Flow, best eff. point	: 209.4 USgpm	Nameplate motor rating	: 2 x 25.00 hp / 18.64 kW
Flow ratio, rated / BEP	: 113.41 %	Panel Max FLA *	(Fixed) : 63 A
Speed ratio (rated / max)	: 95.34 %	* addition of pilot pump, up-sizing HP, or 3x575V will affect System FLA	
Head ratio (rated speed / max speed)	: 87.06 %		
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00		
Selection status	: Acceptable		
Energy Indexes			
PEI (VL)	: 0.46		
ER (VL)	: 54		



1. Manifolds 6" ANSI Class 150 AISI 316SS Schedule 10s ASTM A312 or \varnothing 168.3mm x2mm
 2. Base/Frame AISI 304SS
 3. Standard system layout : panel right facing suction
 4. 3" lug style ANSI 150# class butterfly valve
 5. UL Type 3R/12 rated electrical panel
- Note: panel size will vary with options



Similar system; This does not depict non-standard layout or customized panel size.



GRUNDFOS 
FRESNO, CALIFORNIA 93727 USA

Note:
All dimensions are $\pm 0.5"$
Not for Construction
All dimensions subject to
change without notice.

BoosterpaQ Model: HYDRO MPC E 2CRE45-3

Power: 3x460 60HZ 2x25HP

Job:

Scale: 1:30

Dwg No:

Rev:

0

Date:

5/16/2018

Drawer

71999

Page:

1 of 1

Scope of Supply

Project name	: Gardner, KS Recycle Water	Tag Number	: 001
Consulting engineer	:	Service	:
Customer	:	Model	: HYDRO MPC E 100kA SCCR
Customer ref. / PO	:		2CRE45-3-1 3x460V 60Hz
Quote Number / ID	: 5332528402 / -	Quantity	: 1
Date last saved	: 02/26/2021 2:21 PM	Quoted By (Sales Office)	:
		Quoted By (Sales Engineer)	:

Construction

Construction Code:	Application type: Pressure Boosting - Positive suction pressure above 15 psi
--------------------	--

System information

Qty	Description	
1	Hydro MPC system features Pressure booster system supplied as compact packaged assembly certified and listed by UL (Category QCZJ - Packaged Pumping Systems) for conformance to U.S. and Canadian Standards. All pumps are speed-controlled. - Hydro MPC-E maintains constant pressure through continuous adjustment of the speed of the pumps. - The system performance is adapted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation. - All pumps in operation will run at equal speed.	

Packaged Pump System

Qty	Description	
1	HYDRO MPC E 100kA SCCR 2CRE45-3-1 3x460V 60Hz Hydro MPC system Configuration Environment details Installation location: Indoor - Conditioned Space Environment data Ambient temperature low: 68.00 deg F Ambient temperature High: 68.00 deg F Elevation: 600.0 ft Fluid temperature: 68.00 deg F System configuration Alerts Selected configuration Number of ACTIVE pumps: 2 Number of STAND-BY pumps: 0 Pump type: CRE45-3-1 Multistage, Vertical CI/SS In-Line Pump Fasteners hardware: Zinc Plated Steel Motor installed: 25hp 3x460 PEI(VL): 0.46 ER(VL): 54 Enclosure: Grundfos MLE (TEFC) System details	

Packaged Pump System

Qty	Description		
	<p>Panel: CONTROL MPC E 2x25hp 3x460V 60Hz</p> <p>Power supply: 3x460V</p> <p>Application type: Pressurized</p> <p>Type: MPC-E (CRE) - all VFD (integrated VFD/motor) Packaged Pump System</p> <p>Dry run protection method MPC: Liquid Level Switch (w/ fittings)</p> <p>Tapped flange material for Liquid level switch: E-coat w/1" offset</p> <p>Wire Assembly: Split Base – Separate panel base from Pump Base</p> <p>Low NPSH Pump Option: Not Required</p> <p>System layout: Other - Please describe below</p> <p>The Default drawing is for "Pipe Connections Left, (Panel Right)". Please, Consult Factory for the layout specific selected's Drawing.</p> <p>Custom system layout description: 3.) Suction Left, Discharge Right, (Panel Right), but panel/motor rotated 180</p> <p>Plumbing options</p> <p>System pressure details</p> <p>Min. Inlet Pressure: 10.00 psi.g</p> <p>Max. Inlet Pressure: 10.00 psi.g</p> <p>Pump shutoff pressure (at Max. speed): 147.4 psi.g</p> <p>Max. Possible Pressure (at Max. speed): 157.4 psi.g</p> <p>Max. Allowed Pressure: 0.00 psi.g</p> <p>System pressure details: Please, input a Max allowed pressure value here. It's recommended the value be at least 20psi higher than System Set point</p> <p>System Set point: 254.2 ft</p> <p>System connections</p> <p>Selected system Manifolds are: 6" ANSI 150 #</p> <p>Manifold material: 316SS</p> <p>Pump connection to the manifold port size: 3"</p> <p>Blind flange material: 304SS</p> <p>CheckValve - Side: Discharge</p> <p>CheckValve - Model on Discharge: Flomatic 888R</p> <p>CheckValve - Size on Discharge: 3"</p> <p>CheckValve - Material: Stnd Check Valve & Parts</p> <p>Gauge (set): Trerice - 304SS/brass</p> <p>Isolation Valves - Model on Suction: Butterfly Valve - Flomatic Sylax 3</p> <p>Isolation Valves - Model on Discharge: Butterfly Valve - Flomatic Sylax 3</p> <p>Isolation Valves - Size: 3"</p> <p>Isolation Valves - Material: Stnd Isolation Valve & Parts</p> <p>Gauge Isolation Valve Assembly: Trerice - 304SS</p> <p>Additional options</p> <p>Additional options: Auto Air Vents - per pump</p> <p>Panel Option Package</p> <p>Panel Model: 100kA SCCR</p> <p>Enclosure class: UL Type 3R</p> <p>CIM Expansion Card: CIM 200 MODBUS</p> <p>Panel Options Available, without Panel Option Package selected</p> <p>Emergency/Normal Operating Switches (MPC-E & MPC-E(CUE) systems)</p> <p>Surge Protection</p> <p>Pump Run Indicator Lights</p> <p>Alarm Circuit (Panel mounted System Fault Light + Audible Alarm)</p> <p>Side Mount External Service Disconnect Switch 0-30A (0-25Hp) 460/575V</p> <p>Elapsed Time Meter (Digital)</p> <p>Phase Monitor Relay (Includes Circuit Protection)</p>		

Packaged Pump System

Qty	Description		
	100kA SCCR fault current rating Accessories and Services NSF Approval: NSF61/NSF372 - Drinking Water and Low Lead NOT APPROVED Layout Layout: • Rubber vibration dampers shall be fitted between each pump and baseframe to minimize vibration		

Control Panel

Qty	Description		
1	Hydro MPC system features <p>Pump operation is controlled by CU352 controller, specifically designed to control parallel operation of multiple pumps with the following features/ functions:</p> <ul style="list-style-type: none"> - PID controller with adjustable PI parameters (Kp + Ti) - Constant pressure at setpoint, independent of inlet pressure - Stop function (no flow shutdown) - Automatic cascade control of pumps for optimum efficiency. - Selection of min. time between start/stop, automatic pump changeover and pump priority - Automatic pump test function to prevent idle pumps from seizing up - Standby pump allocation capability - Redundant primary sensor capability - Manual operation - Proportional pressure control - Multi-Sensor zone control with up to six zones • DP SENSORS NEEDED ON ZONES - Differential Pressure/Temperature control using two separate sensors (i.e. discharge - suction subtraction) <ul style="list-style-type: none"> • DP USING IN/OUTLET SENSOR ON MANIFOLDS • DELTA T WILL REQUIRE TEMPERATURE SENSORS (NOT INCL) - Secondary Fall-back sensor will revert to secondary (local) sensor upon primary (remote) sensor failure - Digital Pulse water meter reading (log accumulated flow) - Forced pump changeover - Clock program - Soft pressure build-up - External setpoint influence (via analog input) - Emergency run (via digital input) - Password protection - Possibility of digital remote-control functions (via digital inputs): <ul style="list-style-type: none"> • system on/off • max., min. or user-defined duty • up to 6 alternative setpoints. - Digital inputs and outputs can be configured individually <p>Pump and system monitoring functions:</p> <ul style="list-style-type: none"> - minimum and maximum limits of current value (flow, level, temp., etc.) - built in data logging capability • PC TOOL REQUIRED TO RETREIVE DATA LOG - non return valve (check valve) failure detection - high system pressure protection - low system pressure protection 		

Control Panel

Qty	Description		
	<ul style="list-style-type: none"> - pump curve data loaded into controller to provide end of curve protection - alarm log with the previous 24 warnings/alarms - potential-free changeover contacts for operation and fault. - Grundfos bus communication with optional gateway connections for all popular communication protocols - Ethernet connection (built-in web server) <p>Pre-fabricated and tested packaged pump system including pumps, piping, and wiring complete with Control MPC</p> <p>ALL MPC SYSTEMS ARE PERFORMANCE AND HYDRO TESTED. IF TEST REPORTS ARE REQUIRED, THEN VERIFIED TESTS NEED TO BE ADDED</p>		

Grundfos CU 352 Pump Controller

Advanced pump system controller for parallel connected pumps for HVAC and Pressure Boosting Applications



Compatibility

The CU 352 pump controller can control up to six (6) parallel connected pumps in the following manner:

- Direct BUS control: **CRE, CME, VLSE or LCSE** pumps
- Direct BUS control: Pumps with Grundfos **CUE** drives
- Digital/Analog control: Pumps with external drives (requires **IO 351B** Input/Output module)

HVAC Control Modes

- o Constant Differential Pressure control via remote sensor
- Multi-zone Differential Pressure control up to 6 zones
 - Priority, Minimum or Energy Saving Mode
- o Quadratic, proportional or constant differential pressure control via local sensor
 - Adjustable control curve (Max flow and control head)
 - Efficiency based sequencing automatically updated
- o Constant Flow
- o Constant Temperature
- o Constant Differential Temperature

Pressure Boosting Control Modes

- o Constant Pressure (pump discharge)
- o Quadratic or Proportional discharge pressure
 - Adjustable control curve (Max flow and min. static head)
- o Constant Pressure (remote sensor)

Pump Cascade Control

- o Efficiency based pump sequencing
 - * Updated automatically when setpoint and/or control head are changed
- o Automatic Pump alternation (run hour based)
- o Standby Pumps (single or multiple)
- o Adjustable minimum time between starts / stops
- o Adjustable maximum starts per hour
- o Pump test run (exercise idle pumps)
- o Clock program
- o Proportional Gain and Integral Time adjustment

Application optimized functions:

- o Secondary (Fallback) Sensor
- o Pump curve data (5th or 2nd order polynomial)
 - * Pre-programmed from factory
- o Flow estimation via pump curve data and pressure measurement across pump(s)
- o Reduced operation (generator backup power)
 - Max. kW limit or max. number of pumps
- o Specific energy calculation (kWh per unit volume)
 - *requires flow sensor input
- o Low Flow Stop (Pressure Boosting)
 - Adjustable low flow setting: Energy saver mode, medium flow or high comfort level

Protection and Monitoring

- o Check valve failure detection (MLE motors)
- o Pump outside duty range protection
 - *keeps all operating pumps on their curve
- o Low suction pressure warning and alarm
- o Primary sensor failure reaction setting
- o Soft pressure build-up (Pipe fill mode)
- o Low system pressure warning and alarm
- o High system pressure shutdown
- o Alarm log, last 24, time stamped
- o Data log graph (20 - 3600 samples/hour)
 - (Flow, speed, setpoint, sensor feedback, kW)
- o BMS/EMS communication (see page 4)

Page 2

Grundfos CU 352 Pump Controller

CU 352 Control user interface



Status of inputs and outputs

Electrical overview

Shows status of inputs along with wiring landing points [in brackets]

Status	Operation	Alarm	Settings
1.11.1 - Analog inputs			⚙️
Analog inputs and measured value			
AI1 (CU 352), [51]		35PSI	
(Diff. pressure, pump, high)		7.9mA	
AI2 (CU 352), [54]		35PSI	
(Diff. pressure, pump, low)		7.9mA	
AI3 (CU 352), [57]		0PSI	
(Diff. pressure, external)		0.0mA	

Status	Operation	Alarm	Settings
1.11.2 - Digital inputs			⚙️
DI1 (CU 352), [10]			
(External start/stop)	Active		
DI2 (CU 352), [12]			
(Reduced operation)	Not active		
DI3 (CU 352), [14]			
(Alternative setpoint 2)			
DI1 (IO 351-41), [10]			
(Not used)			

Alarms and warnings

Alarm log - Stores last 24 alarms and warnings.

- > Time event occurred
- > Time event cleared
- > Alarm code for more detailed description.

Status	Operation	Alarm	Settings
3.2 - Alarm log			⚙️ ⚠️
⚠️ AI3-CU352			
Sensor fault (88)			
Occurred at		08/21/2019 10:12 am	
Disappeared at		-- --	
⚠️ System			
Water shortage (214)			
Occurred at		08/21/2019 8:54 am	
Disappeared at		08/21/2019 8:55 am	
⚠️ System			
Water shortage (214)			
Occurred at		08/21/2019 8:54 am	
Disappeared at		08/21/2019 8:55 am	
⚠️ System			
Pumps outside duty range (208)			
Occurred at		08/21/2019 8:54 am	
Disappeared at		08/21/2019 8:54 am	
🔴			
08/21/2019 10:58 am			

Startup Wizard

Startup Wizard

Step by Step installation guide

- > Set time and date format
- > Remove air/Prime pumps
- > Check pump rotation
- > Set primary sensor

Step-by-step installation guide	
17/26 - Priming sequence	⚙️ ⚠️
Close the valve on the outlet side of all the pumps. Prime all pumps and make sure that the suction manifold and the suction pipes are primed as well. Make sure that a correctly sized diaphragm tank has been installed, if necessary, and that the tank precharge pressure is correct. Press [ok] to go to the next page.	
Go to next page	➡️
08/21/2019 11:13 am	

Grundfos CU 352 Pump Controller

Sequence of operation

Hydronic Circulation

The system controller shall operate equal capacity variable speed pumps to maintain a variable (quadratic or linear) or constant differential pressure. The system controller shall receive an analog signal [4-20mA] from a remote or pump system mounted differential pressure sensor. The controller shall be able to receive a system suction pressure and system discharge pressure to determine the system differential pressure (two independent analog signals). The controller shall have the means to protect pumps against dry running via a user defined low suction pressure setting.

Pressure Boosting

The system controller shall operate equal capacity variable speed pumps to maintain a constant or variable (quadratic or linear) pressure. The system controller shall receive an analog signal [4-20mA] from a remote or pump system mounted pressure sensor. The controller shall be capable of simulating the effect of a remote mounted pressure sensor by quadratically reducing the system discharge pressure setpoint as a function of reduced flow (friction loss compensation).

Cascade Control

Standard Cascade Control (Pumping Efficiency Based):

The pump system controller shall adjust pump speed as necessary to maintain system set-point pressure as flow demand changes. The pump system controller shall start additional pumps upon determination of an increase in efficiency utilizing factory programmed (5th order polynomial) curve data. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional gain and Integral time (PI) settings for system optimization.

Optional Cascade Control (Pump Start Speed Based):

As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach the programable start speed, an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional gain and Integral time (PI) settings for system optimization.

Pumps outside duty range (End of curve protection):

When the pumps are outside their allowable operating range, the controller shall switch on an additional pump, distributing a reduced flow through all pumps in operation moving each pump back into its allowable operating region.

Pump Alternation

All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous with only one pump in operation, the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.

Low Flow Stop (Pressure Boosting)

The system controller shall be capable of detecting low flow allowing for pumps to be switched off in an energy saving mode. Upon detection of low flow, the controller shall increase the system setpoint by 5% (adjustable) to store water in a diaphragm or bladder tank and switch off. The pump shall remain off until the system pressure falls 5% below the system setpoint (adjustable). If system flow is still low when the pump switches back on, the pump shall refill the diaphragm tank to 5% above setpoint and switch off again. If system flow increases above the low flow setting, the pump shall return to normal constant pressure mode maintaining the system setpoint.

Page 3

Grundfos CU 352 Pump Controller

Technical data

Altitude above sea level

Maximum 6,560 feet (2000 m.)

Ambient Temperature

During operation: -4°F to +140°F (-20°C to +60°C)

During transportation: -4°F to +140°F (-20°C to +60°C)

- * At temperatures below 32°F (0°C) the display may react slowly.
- * The display should not be exposed to direct sunlight

Relative air humidity

5 to 95%

Enclosure class

UL type 3R when mounted in the front of a panel with UL type rating 1, 2, 3, 3R, 5, 12, 12K or 13. Overall control panel rating of Type 4/4X available on request.

Supply voltage

1 x 100-240 VAC +/- 10% 50/60Hz, PE
(Class 1 equipment)

Power consumption

Maximum 22 W

Backup battery

The optional backup battery can keep the CU352 powered during intermittent power outages.

The CU 352 will monitor the following:

- short circuit
- wrong polarity
- defective battery
- battery missing
- low battery voltage

Digital inputs (3)

Open-circuit voltage	24 VDC
Closed-circuit current	5 mA, DC
Frequency range	0-4 Hz

Analog inputs (3)

	0-20 mA
Input current and voltage	4-20 mA
	0-10 V
Tolerance	± 3.3 % of full scale
Repetitive accuracy	± 1 % of full scale
Input resistance, current	< 250 Ω
Input resistance, voltage	> 50 kΩ ± 10%
	24 V, 30 mA
Supply to sensor	short-circuit protected

Relay outputs (2)

Normally open contacts	C, NO
Maximum contact load	240 VAC, 2 A
Minimum contact load	5 VDC, 10 mA

Communication protocols

For connection to building management systems, Communication Interface Modules (CIM) can be supplied with the CU 352 controller.

Protocol	CIM Type
LONworks	110
PROFIBUS DP	150
PROFINET IO	500
Modbus RTU	200
Modbus TCP	500
BACnet MS/TP	300
BACnet IP	500
Ethernet IP	500

MLE

Product compatibility

- **Multi-stage:** CRE, CRIE, CRNE, MTRE, MTSE, SPKE, CME
- **Single-stage:** TPE2, TPE3, VLSE, LCSE
- **Systems:** Hydro MPC-E, Hydro Multi-E, Hydro Multi-B, Hydro Solo-E, CMBE home booster.



TN06 5684 2219

MLE is a dedicated motor-drive system for pumps and other applications. Pumps equipped with MLE motors overcome application challenges and save energy in a variety of pump installations in order to reach the lowest Life Cycle Cost (LCC) possible.

Integrated drives

Integrated drives are beneficial because they are installed on non-controlled pumps at no additional installation cost. Once the power supply is connected and the pump is fitted into the pipe system, they are ready to operate at the desired setpoint.

Operating pumps with MLE also reduces CAPEX (capital expense) of additional cabinets, components and facility space by having the entire pump system in line with the pipe system.

MLE is the result of Grundfos' efficient motor technology and it is an efficient IE5 motor, with an efficiency much higher than NEMA Premium, which minimizes OPEX (operating expense).

Robustness throughout the system

The Grundfos full line supply of components, from the power supply to pipe fittings, provides the most robust solutions:

- Built-in protection against power supply disturbances, environment and motor load.
- MLE is designed to mitigate bearing currents.
- No cooling fans in drive (wear part).

MLE product range

1 x 200-240 V	0.33 - 2.0 HP
3 x 200-240 V	1.5 - 7.5 HP
3 x 440-480 V	0.33 - 15 HP*

* Up to 30 HP available with different specifications.

Features and benefits

Feature	Benefit
Application control	
Control modes	Easy commissioning to match system design criteria.
Multipump function including alternating, back-up, or cascade	Neglects the need for external controllers and continuous operation by redundant pump and sensor if either component fails.
Differential pressure or temperature with 2 sensors	Lower CAPEX by common inexpensive sensor types.
Pump curve adjustments and run at power limit	Stabilizes unstable pump curves and extends operating range.
Setpoint influence	Adapts QH to internal or measured values.
Energy saving for lower OPEX	
AUTOADAPT or FLOWLIMIT	Continuously adapts to the most efficient curve and reduces pressure loss in the system.
Low-flow stop function	Improved energy optimization and comfort.
ECM motor that exceeds the NEMA Premium efficiency levels	ECM motors have significantly lower motor loss than NEMA Premium motors. This alone reduces energy consumption by 10 % with a typical pump load profile.
Condition monitoring	
Limit Exceed function	Any value can be supervised to protect the system.
Loss of prime and dry run	Protects the shaft seal.
Cavitation protection	Protects the impellers.
Flow estimate and heat energy monitor	Monitoring of the heating system's performance.
Overload and temperature	Protects the frequency converter and motor.
Stop at minimum speed	Protects the pump and saves energy.
Motor bearings monitors	Ensures uptime by preventive maintenance.
Robustness	
Operating temperature between -4 and +140 °F	Allows installation almost anywhere and high margins in control rooms, resulting in longer product service life.
Impulse transient resistance (VDE0160 compliant)	Resistance against lightning, ESD, switching impulses and utility fault clearing.
Interruptions and voltage sags (SEMIF47 compliant)	Keeps process running and derates the pump to the available power.
Line harmonics resistance (EN 61000-4-13, class 3)	Built-in compensation of disturbance to avoid overheating of motor windings and maintaining a steady pump operation.
Built-in RFI filters	Neglects the need for external components.
NEMA3 / NEMA4 enclosures	Installed in-line to pipe systems at no added cost.

Grundfos iSOLUTIONS

Grundfos iSOLUTIONS delivers the optimal combination of pumps, drives and auxiliary components for the specific application, incorporating special features and functions, and building on application knowledge and experience.

Grundfos iSOLUTIONS allows easy integration of pumps, drives, measurements, controls, protections, and communication, saving you valuable engineering, installation and commissioning time.

To learn more, visit: www.grundfos.com/isolutions

Sensors

MLE is sensor-independent and controls the pump to any measured feedback.

Grundfos offers several sensors to be used in pump solutions:

- pressure sensors
- temperature sensors
- differential pressure sensors
- differential temperature sensors
- flow meters.

Grundfos GO Remote

Grundfos GO Remote for iOS and Android ensures easy and quick commissioning, monitoring and servicing of pumps with MLE motors.



TM07 4786 2419

Technical specifications

Motor data			
	Operating range (rpm)	Constant power (rpm)	Constant torque (rpm)
Speed range	180-2000	1740-2000	900-1740
	360-4000	3480-4000	1750-3480
	360-4000	3400-4000	2000-3400
	500-5900	4000-5900	-
Voltage tolerances	± 10 %		
Frequency	50-60 Hz ± 5 %		
Network	TN/TT (optional: IT) according to IEC 60364		
Environmental limits			
Degree of protection	NEMA3 / NEMA4		
Operating temp.	-4 to +140 °F derating above 122 °F		
Storage temp.	-4 to +140 °F		
Altitude	0-3280 ft without derating / 0-11480 ft with derating		
Humidity	0-95 %, non-condensing		
Inputs/outputs	FM100	FM200	FM300
Digital inputs	1	1	2
Digital inputs/ outputs	1	1	2
Relay outputs	-	2	2
Analog inputs	1 (only V)		
Pt100/Pt1000 inputs	-	-	2
+5 V supply	Y	Y	Y
+24 V supply	-	Y	Y
Grundfos Digital Sensor input	-	Y	Y
LiqTec sensor input	-	-	Y
Digital inputs (dedicated)	0-5 V		
Digital inputs/ outputs	0-24 V, resistive or inductive		
Analog input	0-20 mA / 4-20 mA, 0.5 - 3.5 V / 0-5 V / 0-10 V		
Relay output	250 V AC/30 V DC, max. continuous current 2 A rms		
Connectivity			
Wireless (radio)	Yes, GENlair		
RS-485	Yes, GENlair		
Communication options	• LONWorks (CIM 100)		
	• PROFIBUS DP (CIM 150)		
	• Modbus RTU (CIM 200)		
	• GSM/GPRS (CIM 250)		
	• 3G/4G cellular (CIM 260)		
	• GiC/GRM 3G/4G (CIM 280)		
	• BACnet MS/TP (CIM 300) PROFINET IO (CIM 500)		
	• Modbus TCP (CIM 500)		
	• BACnet IP (CIM 500)		
• Ethernet IP (CIM 500)			
Compliance			
Conformity to standards	CE, EAC, RCM, CCC, and cURus (UL)		
Harmonics	IEC/EN 61000-3-12		
EMC	Up to 10.0 HP (7.5 HP low speed): Category C1 according to EN 61800-3, corresponding to CISPR 11, class B (residential area)		
	Above 10.0 HP (7.5 HP low speed): Category C3 according to EN 61800-3, corresponding to CISPR 11, class A, group 2 (industrial area)		

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ECM: 1264915

Hydro MPC-E CRE (Integrated VFD/PM Motor) Guide Specification

Part I – GENERAL

1.1 WORK INCLUDED

- A. Variable Speed Packaged Pumping System

1.2 REFERENCE STANDARDS

The work in this section is subject to the requirements of applicable portions of the following standards:

- A. Hydraulic Institute
- B. ANSI – American National Standards Institute
- C. ASTM – American Society for Testing and Materials
- D. IEEE – Institute of Electrical and Electronics Engineers
- E. NEMA – National Electrical Manufacturers Association
- F. NEC – National Electrical Code
- G. ISO – International Standards Organization
- H. UL – Underwriters Laboratories, Inc.

Part 2 – PRODUCTS

2.1 VARIABLE SPEED PACKAGED PUMPING SYSTEM

- A. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
- B. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the same manufacturer.
- C. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.
- D. The complete packaged pumping system shall be NSF61 / NSF372 Listed for drinking water and low lead requirements.
- E. The packaged pump system shall be ASHRAE 90.1 – 2010 compliant without the need of a remote mounted sensor. The control logic used to simulate a remote mounted sensor shall be proportional pressure control with squared or linear adaptation. An actual flow rate or calculated flow rate based on performance curves (5th order polynomial) loaded into the controller; shall be used to adjust setpoint pressure in proportional pressure control.

2.2 PUMPS

- A. All pumps shall be ANSI NSF 61 / NSF372 Listed for drinking water and low lead requirements.
- B. The pumps shall be of the in-line vertical multi-stage design.
- C. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
- D. Small (CR3 to CR20) Vertical In-Line Multi-Stage Pumps (Nominal flow from 3 to 125 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
2. The suction/discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as determined by the pump station manufacturer.
3. Pump Construction.
 - a. Suction/discharge base, pump head, motor stool: Cast iron (Class 30)
 - b. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
 - c. Shaft: 316 or 431 Stainless Steel
 - d. Impeller wear rings: 304 Stainless Steel
 - e. Shaft journals and chamber bearings: Silicon Carbide
 - f. O-rings: EPDM

Shaft couplings for motor flange sizes 184TC and smaller shall be made of cast iron or sintered steel. Shaft couplings for motor flange sizes larger than 184TC shall be made of ductile iron (ASTM 60-40-18).

Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel (ASTM CF-8M) resulting in all wetted parts of stainless steel.

4. The shaft seal shall be a balanced o-ring cartridge type with the following features:
 - a. Collar, Drivers, Spring: 316 Stainless Steel
 - b. Shaft Sleeve, Gland Plate: 316 Stainless Steel
 - c. Stationary Ring: Graphite embedded Silicon Carbide
 - d. Rotating Ring: Graphite embedded Silicon Carbide
 - e. O-rings: EPDM
5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. The entire cartridge shaft seal shall be removable as a one-piece component.
6. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

E. Large (CR32 to CR155) In-line Vertical Multi-Stage Pumps (Nominal flows from 130 to 1070 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.
2. The suction/discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.
3. Pump Construction.
 - a. Suction/discharge base, pump head: Ductile Iron (ASTM 70-50-05)
 - b. Shaft couplings, flange rings: Ductile Iron (ASTM 70-50-05)
 - b. Shaft: 431 Stainless Steel
 - c. Motor Stool: Cast Iron (ASTM Class 30)
 - d. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
 - e. Impeller wear rings: 304 Stainless Steel
 - f. Intermediate Bearing Journals: Silicon Carbide
 - g. Intermediate Chamber Bearings: Leadless Tin Bronze
 - h. Chamber Bushings: Graphite Filled PTFE
 - i. O-rings: EPDM

Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel (ASTM CF-8M) resulting in all wetted parts of stainless steel.

4. The shaft seal shall be a balanced O-ring cartridge type with the following features:
 - a. Collar, Drivers, Spring: 316 Stainless Steel
 - b. Shaft Sleeve, Gland Plate: 316 Stainless Steel
 - c. Stationary Ring: Graphite embedded Silicon Carbide
 - d. Rotating Ring: Graphite embedded Silicon Carbide
 - e. O-rings: EPDM
5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. The entire cartridge shaft seal shall be removable as a one-piece component.
6. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

2.3 INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

- **Efficiency:** The motors shall be of permanent magnet design meeting IE5 efficiency levels where the combined motor and VFD efficiency exceed NEMA Premium Efficiency standards.
- **Bearing Current Mitigation:** Motors shall use WSB (Winding Set Back) and/or CHS (Coil Head Shield) designs that reduce the Bearing Voltage Ratio (BVR) far enough to eliminate damaging bearing currents. Shaft grounding rings/brushes or common mode filters shall not be required.
- **Motor Enclosure/Cooling:** The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face with Class F insulation and a temperature rise class no higher than Class B. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.
- The power and control electronics shall be housed in a UL Type 3 enclosure and the combined motor/VFD rating shall be IP55 (protection against dust and nozzle directed water from any direction).
- The VFD shall be of the PWM (Pulse Width Modulation) design using IGBT (Insulated Gate Bipolar Transistor) technology.
- The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor current suitable for centrifugal pump control and to eliminate the need for motor de-rating.
- The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during periods of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.
- An integral RFI filter shall be standard in the VFD.
- The VFD shall have a minimum of two skip frequency bands which can be field adjustable.
- The VFD shall have internal solid-state overload protection designed to trip within the range of 105-110% of rated current.

- The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.
- The integrated VFD motor shall have, as a minimum, the following input/output capabilities:
 1. Speed Reference Signal: 0-10 VDC, 4-20mA
 2. Digital remote on/off
 3. Fault Signal Relay (NC or NO)
 4. Fieldbus communication port (RS485)
- Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 20,000 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

2.4 PUMP SYSTEM CONTROLLER

- A. The pump system controller shall be a standard product developed and supported by the pump manufacturer.
- B. The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a color display with a minimum screen size of 3-1/2" x 4-5/8" for easy viewing of system status parameters and for field programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.
- C. Galvanic Isolation: The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.
- D. Backup Battery: The controller shall have the ability to be connected to a backup battery to supply power to the controller during periods of loss of supply power.
- E. Home Status Screen: The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
 - Current value of the control parameter, (typically differential pressure)
 - Most recent existing alarm (if any)
 - System status with current operating mode
 - Status of each pump with current operating mode and rotational speed as a percentage (%)
 - Estimated flow-rate, (or actual flow if flow sensor is used)
 - One user defined measured parameter (i.e. power consumption)
- F. Inputs/Outputs: The controller shall have as a minimum the following hardware inputs and outputs:
 - Three analog inputs (4-20mA or 0-10VDC)
 - Three digital inputs
 - Two digital outputs
 - Ethernet connection (built-in web server)
 - Field Service connection to PC for advanced programming, software and/or firmware upgrades and data logging
- G. Pump system programming: As a minimum, the following parameters shall be available and/or field adjustable:
 - Sensor Settings: Suction, Discharge, Differential Pressure [analog supply/range]
 - PI Controller: Proportional gain (Kp) and Integral time (Ti)
 - Low suction: Pressure/level shutdown via digital contact

- Limit Exceeding function: For low system, low suction warnings and shut down [via analog input]
 - Flow meter settings (if used, analog signal)
- H. Pump Curve Data: The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller. Pump curve data shall be used for the following:
- a. Display and data logging of calculated flow rate
 - b. Variable pressure control (quadratic or proportional)
 - c. Pump outside of duty range protection
 - d. Sequence pumps based on efficiency
- I. Variable Pressure Control: The controller shall have variable pressure control to compensate for pipe friction loss by decreasing the pressure set-point at lower flow-rates and increasing the pressure set-point at higher flow-rates by using the actual flow rate or calculated flow rate. Variable pressure control that uses power consumption and speed only shall not be considered equal to variable pressure control that uses actual differential pressure measurement along with pump power and speed.
- J. Multi-Sensor: The controller shall be able to control using up to six differential pressure (DP) sensors (zones). Each zone shall have a programmable maximum and minimum DP range. The controller shall be capable of an energy optimal mode where pump speed/energy shall be reduced until any of the zones reach the minimum DP setting.
- K. Check Valve Failure Detection (Systems with integrated VFD motors): The system controller shall be able to detect motors turning in the opposite direction and give check valve failure notification.
1. For minor leaks the pump shall start with a warning indicated
 2. For major leaks the pump shall remain off to prevent damage with an alarm indication
- L. Pulse flow meter: The system controller shall be able to receive pulse readings from a digital pulse meter and log/display accumulated flow.
- M. DP Subtraction: The system controller shall be able to control off subtraction of two pressure or temperature sensors for differential pressure or differential temperature control.
- N. Programmable Setpoints: The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).
- O. Setpoint Influence: The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically differential pressure) by measuring an additional parameter. (Example: Lower the system differential pressure set-point based on a flow or outdoor temperature measurement).
- P. Remote Control: The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.
- Q. Setpoint Ramp: The controller shall be able to adjust the ramp time of a change in set point (increase and decrease).
- R. Warnings and Alarms: The pump system controller shall store up to 24 warnings and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:

Individual pump failure
VFD trip/failure

Check valve failure
Loss of sensor signal (4-20 mA)

Loss of remote set-point signal (4-20mA)	External Fault
Pump outside of duty range	Limit 1 and 2 exceeded*

*The controller shall be capable of monitoring two analog signals (i.e. suction pressure and discharge pressure) for additional pump or system protection.

- S. Built-in data log: The controller shall have built-in data logging capability. Logged values shall be graphically displayed on the controller and shall be downloadable to a notebook/pc as a delimited text file. A minimum of 7200 samples per logged value shall be available for the following parameters:
 - Estimated flow-rate (or actual flow if flow sensor is connected)
 - Speed of pumps
 - Process Value/sensor feedback (usually differential pressure)
 - Power consumption
 - Controlling parameter (setpoint)
 - Inlet pressure (when remote differential pressure is the primary sensor)
- T. Redundant Primary Sensor: The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor.
- U. Secondary Sensor: Upon loss of signal from the remote sensor, the controller shall be capable of reverting control to the pump system mounted sensors with a programmable setpoint. The pumps shall maintain a constant, proportional or quadratic pressure across the system until the remote setpoint signal is restored.
- V. Pump Test: The controller shall have a pump "Test Run" feature such that pumps are switched on during periods of inactivity (system is switched to the "off" position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of three to four seconds every 24 hours, 48 hours or once per week and at a programmable time of day.
- W. Reduced Operation: During backup generator operation, the controller shall be capable of reducing the power consumed by the pump system by either limiting the number of pumps in operation or by limiting the amount of power consumption (kW). The controller shall receive a digital input indicating backup generator operation.
- X. Power and Energy Consumption: The controller shall be capable of displaying instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours).
- Y. Specific Energy: When a flow sensor is connected, the controller shall be capable of displaying instantaneous specific energy in Watt-hours per gallon (Wh/gal) or Watt-hours per 1,000 gallons (Wh/kgal).
- Z. Built-in Ethernet: The controller shall have an Ethernet connection with a built-in web server allowing for connection to a building computer network with read/write access to the controller via a web browser.
- AA. Service Contact Information: The controller shall have a programmable Service Contact Field that can be populated with service contact information including: contact name, address, phone number(s) and website.

2.5 CONTROL PANEL

SCCR: The complete control panel assembly shall have a Short Circuit Current Rating of 100 kA

BMS Integration: Standard shall be BACnet MS/TP

*Other protocols available: BACnet IP, Ethernet IP, Modbus RTU, Modbus TCP, LON

The pump system controller shall be mounted in a UL Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire UL Type 3R control panel shall be UL 508 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions. The control panel shall include the following:

- 80 dB System Fault Audible Alarm with push button to silence
- Emergency/Normal Operation Switches (Control bypass)
- Individual Service Disconnect Switches (accessible outside of panel)
- Pump Run Lights
- System Fault Light
- Surge Arrestor

2.6 SEQUENCE OF OPERATION

- A. The system controller shall operate equal capacity variable speed pumps to maintain a constant differential pressure (system set-point from remote DP sensor) or proportional pressure differential pressure setpoint (system setpoint from local mounted sensor(s)), depending on the application. The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer on the discharge and suction manifolds, indicating the actual system pressure and inlet pressure. The controller shall be capable of controlling off the subtraction of discharge minus suction transducers for differential pressure across the manifolds.

Standard Cascade Control (Pumping Efficiency Based):

The pump system controller shall adjust pump speed as necessary to maintain system set-point pressure as flow demand increases. Utilizing the pump curve information (5th order polynomial), the pump system controller shall stage on additional pumps when pump hydraulic efficiency will be higher with additional pumps in operation. Exception: When the flow and head are outside the operating pump(s) allowable operating range the controller shall switch on an additional pump thus distributing flow and allowing all pump(s) to operate in allowable operating range. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional Gain and Integral time (PI) settings for system optimization.

Optional Cascade Control (Pump Start Speed Based):

As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach 96% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional Gain and Integral time (PI) settings for system optimization.

- B. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.
- C. All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.
- D. The system controller shall be able to control a pressure maintenance pump, (jockey pump), in the system in pressure boosting applications. The set point of the pressure maintenance pump shall be able to be any value above or below the pump system's set point. The pressure maintenance pump shall be able to be staged on as back-up pump when capacity of pump system is exceeded.

2.7 LOW FLOW STOP FUNCTION (Constant Pressure Applications)

The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable and shall not be used.

Optional Adder - Diaphragm Tank

Standard Low Flow Stop and Energy Saving Mode

If a low or no flow shut-down is required (periods of low or zero demand) a bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band, adjustable). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band, adjustable). Upon low flow shut-down a pump shall be restarted in one of the following two ways:

- A. Low Flow Restart: If the low flow condition still exists, the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.
- B. Normal Flow Restart: If the pump system controller determines a low flow condition no longer exists the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.

[OPTIONAL] Low Flow Stop and Energy Saving Mode

The pump system controller shall be capable receiving a digital signal from a flow switch or an analog signal from a flow meter to indicate a low flow condition. A bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When low flow is detected (signal from flow switch or meter), the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band). The pump shall remain in the energy saving on/off mode during low flow indication. When low flow is no longer present (low flow indication ceases), the pump(s) shall resume constant pressure operation.

It shall be possible to change from the standard low flow stop to the optional low flow stop (and vice-versa) via the user interface.

2.7 SYSTEM CONSTRUCTION

- A. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation can not exist in manifold during operation to prevent bacteria growth inside manifold.
- B. The suction and discharge manifolds material shall be 316 stainless steel. Manifold connection sizes shall be as follows:
 - 3 inch and smaller: Male NPT threaded
 - 4 inch through 8 inch: ANSI Class 150 rotating flanges
 - 10 inch and larger: ANSI Class 150 flanges

- C. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
- D. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
- E. For systems that require a diaphragm tank, a connection of no smaller than 3/4" shall be provided on the discharge manifold.
- F. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.
- G. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2 1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
- H. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.
- I. The base frame shall be constructed of corrosion resistant 304 stainless steel for systems with CR pump sizes up to CR64. The pump system base shall be powder coated white aluminum RAL9006, carbon steel ASTM A36 structural steel, for systems with CR95 and larger pumps.
- J. Rubber vibration dampeners shall be fitted between each pumps and base frame to minimize vibration.
- K. Depending on the system size and configuration, the control panel shall be mounted in one of the following ways:
 - On a 304 stainless steel fabricated control cabinet stand attached to the system skid.
 - On a 304 stainless steel fabricated skid, separate from the main system skid
 - On its own base (floor mounted with plinth)

2.8 TESTING

- A. The tester used for testing the pump system shall be constructed and calibrated according to the requirements of hydraulic test standard ISO 9906.
- B. The entire pump station shall as a minimum be factory tested for functionality and documented results of functionality test supplied with pump station.

Functionality testing shall include the following parameters:

- 1. Complete System Hydrostatic Test – 1.5 times the nameplate maximum pressure
- 2. No-Flow Detection Shutoff Test

3. Water Shortage Test
 4. Two-Point Setpoint Performance Test.
- C. Water used for testing shall be treated with three different filtration systems to ensure only clean water is used for testing pump station.
1. 25 micron mechanical filter – removes solid parts from water
 2. Activated carbon filter – keeps water clear and eliminates odor
 3. Ultraviolet light system – kills all bacteria growth
- D. Optional performance testing shall include: (Select one)
1. 10-Point Verified Performance Test
 2. Witnessed Verified Performance Test

2.9 WARRANTY

- A. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

Grundfos Warranty Policy U.S.

The Grundfos warranty covers that the products are not defective due to material nor workmanship.

For Grundfos manufactured products, the warranty covers a standard period of no more than 30 months from the date of manufacture. For PACO, Yeomans, Chicago Pump, Morris, and Sewer Chewer manufactured products, the warranty covers a standard period of no more than 18 months from shipment date. If the pump is installed or commissioned by Grundfos or Grundfos Authorized Service Partners, then the warranty period will cover 24 months from installed date for Grundfos manufactured products and 12 months for PACO, Yeomans, Chicago Pump, Morris, and Sewer Chewer manufactured products (proper startup or commission data required).

Grundfos will determine to repair or replace based on its costs. The parts will be replaced free of charge, but the cost of transport to and from the place of delivery as well as any costs for uninstallations or reinstallations shall be absorbed by the purchaser of the product.

Grundfos reserves the right to extend our service partner network of choice, depending on product range. It is very important the Grundfos warranty does not cover loss of profit, business, or any indirect or consequential damage of any kind whatsoever. Products sold but not manufactured by Grundfos are subject to the warranty granted by the manufacturer of said products and not by Grundfos warranty (i.e. Baldor motors).

Grundfos will not be responsible for system design faults, pump seized due to system deposits, nor damaged packaging. Grundfos will not be responsible for the damage or wear of its products caused by abnormal operating conditions, accidents, abuse, misuse, alterations, unauthorized repairs, or if the product was not installed according to the Installation Instructions and Operation issued by Grundfos. Grundfos will not be responsible for damages nor losses resulting from the use or operation of the product and are not liable for any consequential losses. Wearable parts will not be covered under warranty for normal wear, or misapplication. Wearable parts include mechanical seals and wear rings. Mechanical Seals are NOT warranted beyond 24 hours from time of factory startup.

To obtain warranty, the defective product must be returned to a Grundfos product distributor from which it was purchased together with the proof of purchase, installation date, failure date, and any other installation support data. Unless otherwise specified, the distributor or dealer will contact Grundfos or an authorized service partner to request instructions. Any defective product to be returned to Grundfos or to an authorized service partner must be sent with freight from customer, with the documentation that supports the warranty claim, as well as an authorization for the return of materials (RMA) issued by Grundfos.

Grundfos reserves the right to complete an on-site visit to diagnose in accordance with customer acceptance. This determination includes, but is not limited to, the size of the pump, the application (essential business), and/or the criticality of the operations. If warranty applies, then travel and expenses will be covered under warranty. If it is determined to not be warranty, then travel, expenses, and labor will be charged at the customer's expense.

Products that have been exposed to radioactive materials will not be accepted in return by Grundfos. Those products exposed to toxic materials or were in a mining application require 3 forms: (1) Decontamination, (2) Certificate of Cleanliness (COC), and (3) MSDS / SDS Forms. The warranty claim in this case must be processed with the dealer from which it was purchased. For non-potable, only (2) COC is required.

TAB2 - BoosterpaQ Information - Alt.

**Gardner, KS - SCOPE
Alternative Selection**

**HYDRO MPC EC
2CR 45-3 with VFDs
in Control Panel**

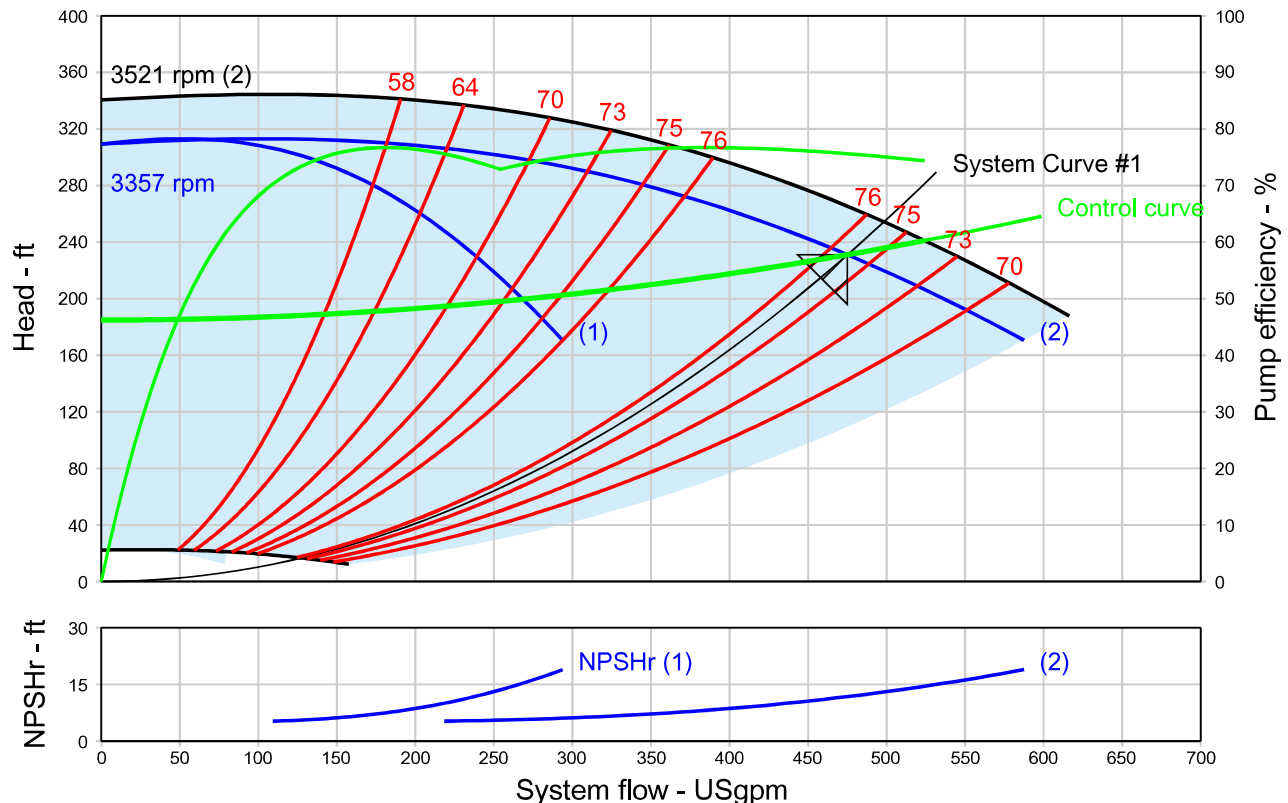
TAB 2

BoosterpaQ Information

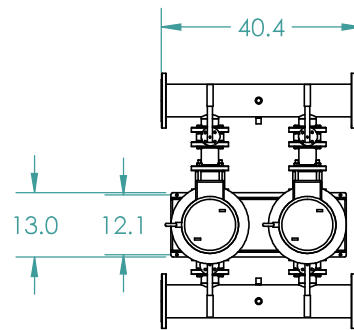
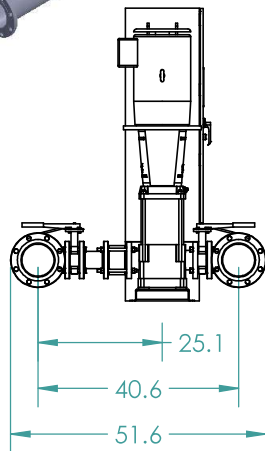
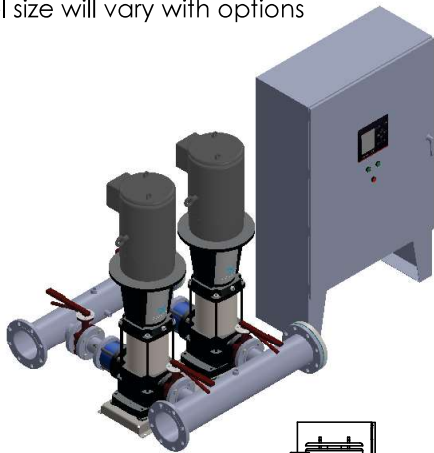
-Alternative selection w/more panel options & panel mount VFDs

Pump Performance Datasheet

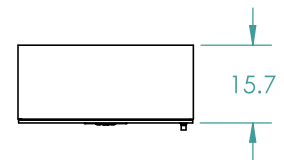
Customer	:		Quote Number / ID	:	5332528402
Customer ref. / PO	:		Model	:	Hydro MPC-EC (CUE) 2CR 45-3-1
Tag Number	:	002		:	3x460V 60Hz
Service	:		Part Number	:	Custom system
Quantity	:	1	Stages	:	3
Quantity of pumps	:	2 active + 0 standby	Based on curve number	:	RC10199_SB Rev 0
			Date last saved	:	02/26/2021 5:06 PM
Operating Conditions			Liquid		
System flowrate	:	475.0 USgpm	Liquid type	:	Cold Water
Flowrate per pump	:	237.5 USgpm	Additional liquid description	:	
Differential head / pressure, rated (requested)	:	231.1 ft	Temperature, max	:	68.00 deg F
Differential head / pressure, rated (actual)	:	231.2 ft	Fluid density, rated / max	:	1.000 / 1.000 SG
Suction pressure, min / max	:	10.00 / 10.00 psi.g	Viscosity, rated	:	1.00 cP
NPSH available, rated	:	Ample	Vapor pressure, rated	:	0.34 psi.a
Site Supply Frequency	:	60 Hz	Material		
Power Supply	:	3ph 460V	Material selected	:	Standard - Cast Iron / 304 Stainless Steel
Performance			Pressure Data		
Speed, rated	:	3357 rpm	Pump shut off pressure	:	145.5 psi.g
Speed, maximum	:	3521 rpm	Maximum allowable suction pressure	:	145.0 psi.g
Speed, minimum	:	900 rpm	Driver & Power Data (@Max density)		
Pump efficiency	:	75.62 %	Motor sizing specification	:	Max power (non-overloading)
NPSH required / margin required	:	11.77 / 0.00 ft	Margin over specification	:	0.00 %
Ns (imp. eye flow) / Nss (imp. eye flow)	:	1,733 / 9,116 US Units	Service factor	:	1.00
Head maximum, rated speed	:	313.0 ft	Rated power (based on duty point)	:	2 x 18.32 hp
Head rise to shutoff	:	33.88 %	Max power (non-overloading)	:	2 x 19.44 hp
Flow, best eff. point	:	209.4 USgpm	Nameplate motor rating	:	2 x 25.00 hp / 18.64 kW (Fixed)
Flow ratio, rated / BEP	:	113.41 %	Panel Max FLA *	:	70 A
Speed ratio (rated / max)	:	95.34 %	* addition of pilot pump, up-sizing HP, or 3x575V will affect System FLA		
Head ratio (rated speed / max speed)	:	87.06 %			
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	:	1.00 / 1.00 / 1.00 / 1.00			
Selection status	:	Acceptable			
Energy Indexes					
PEI (VL)	:	0.46			
ER (VL)	:	54			



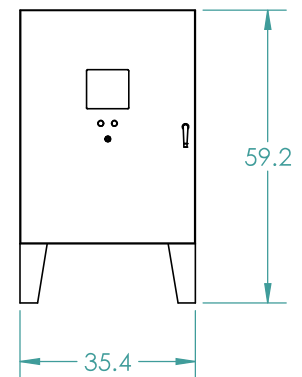
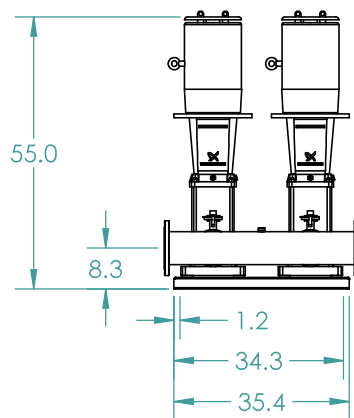
1. Manifolds 6" ANSI Class 150 AISI 316SS Schedule 10s ASTM A312 or $\varnothing 168.3\text{mm} \times 2\text{mm}$
 2. Base/Frame AISI 304SS
 3. Standard system layout : panel right facing suction
 4. 3" lug style ANSI 150# class butterfly valve
 5. UL Type 12 rated electrical panel
- Note: panel size will vary with options



Similar system; This does not depict non-standard layout or customized panel size.



Custom Panel size:
60x48x18



GRUNDFOS 
FRESNO, CALIFORNIA 93727 USA

Note:
All dimensions are $\pm 0.5"$
Not for Construction
All dimensions subject to
changewithout notice.

BoosterpaQ Model: HYDRO MPC E 2CR45-3

Power: 3x460 60HZ 2x25HP

Job:

Scale: 1:30

Dwg No:

Rev:

Date:

Drawer

Page:

0

2/22/2018

71999

1 of 1

Scope of Supply

Project name	: Gardner, KS wash water	Tag Number	: 002
Consulting engineer	:	Service	:
Customer	:	Model	: HYDRO MPC EC 100kA SCCR
Customer ref. / PO	:		2CR45-3-1 3x460V 60Hz
Quote Number / ID	: 5332528402 / -	Quantity	: 1
Date last saved	: 02/26/2021 5:06 PM	Quoted By (Sales Office)	:
		Quoted By (Sales Engineer)	:

Construction

Construction Code:	Application type: Pressure Boosting - Positive suction pressure above 15 psi
--------------------	--

System information

Qty	Description	
1	Hydro MPC system features Pressure booster system supplied as compact packaged assembly certified and listed by UL (Category QCZJ - Packaged Pumping Systems) for conformance to U.S. and Canadian Standards. All pumps are speed-controlled. - Hydro MPC-E maintains constant pressure through continuous adjustment of the speed of the pumps. - The system performance is adapted to the demand through cutting in/ out the required number of pumps and through parallel control of the pumps in operation. - All pumps in operation will run at equal speed.	

Packaged Pump System

Qty	Description	
1	HYDRO MPC EC 100kA SCCR 2CR45-3-1 3x460V 60Hz Hydro MPC system Configuration Environment details Installation location: Indoor - Conditioned Space Environment data Ambient temperature low: 68.00 deg F Ambient temperature High: 68.00 deg F Elevation: 600.0 ft Fluid temperature: 68.00 deg F System configuration Alerts Alerts: Drawing missed. Please Consult factory Alerts: Wiring Diagram missed. Please Consult factory Selected configuration Number of ACTIVE pumps: 2 Number of STAND-BY pumps: 0 Pump type: CR45-3-1 Multi-stage, Vertical CI/SS In-Line Pump Fasteners hardware: Zinc Plated Steel Motor installed: 25hp 3x460 PEI(VL): 0.46 ER(VL): 54 Enclosure: ODP System details	

Packaged Pump System

Qty	Description		
	<p>Panel: CONTROL MPC EC 2x25hp 3x460V 60Hz</p> <p>Power supply: 3x460V</p> <p>Application type: Pressurized</p> <p>Type: MPC-E (CUE) - all VFD (panel mounted) Packaged Pump System</p> <p>Dry run protection method MPC: Liquid Level Switch (w/ fittings)</p> <p>Tapped flange material for Liquid level switch: E-coat w/1" offset</p> <p>Wire Assembly: Split Base – Separate panel base from Pump Base</p> <p>Low NPSH Pump Option: Not Required</p> <p>System layout: Other - Please describe below</p> <p>The Default drawing is for "Pipe Connections Left, (Panel Right)". Please, Consult Factory for the layout specific selected's Drawing.</p> <p>Custom system layout description: 3.) Suction Left, Discharge Right, (Panel Right), but panel/motor rotated 180</p> <p>Plumbing options</p> <p>System pressure details</p> <p>Min. Inlet Pressure: 10.00 psi.g</p> <p>Max. Inlet Pressure: 10.00 psi.g</p> <p>Pump shutoff pressure (at Max. speed): 147.4 psi.g</p> <p>Max. Possible Pressure (at Max. speed): 157.4 psi.g</p> <p>Max. Allowed Pressure: 0.00 psi.g</p> <p>System pressure details: Please, input a Max allowed pressure value here. It's recommended the value be at least 20psi higher than System Set point</p> <p>System Set point: 254.2 ft</p> <p>System connections</p> <p>Selected system Manifolds are: 6" ANSI 150 #</p> <p>Manifold material: 316SS</p> <p>Pump connection to the manifold port size: 3"</p> <p>Blind flange material: 304SS</p> <p>CheckValve - Side: Discharge</p> <p>CheckValve - Model on Discharge: Flomatic 888R</p> <p>CheckValve - Size on Discharge: 3"</p> <p>CheckValve - Material: Stnd Check Valve & Parts</p> <p>Gauge (set): Trerice - 304SS/brass</p> <p>Isolation Valves - Model on Suction: Butterfly Valve - Flomatic Sylax 3</p> <p>Isolation Valves - Model on Discharge: Butterfly Valve - Flomatic Sylax 3</p> <p>Isolation Valves - Size: 3"</p> <p>Isolation Valves - Material: Stnd Isolation Valve & Parts</p> <p>Gauge Isolation Valve Assembly: Trerice - 304SS</p> <p>Additional options</p> <p>Additional options: Auto Air Vents - per pump</p> <p>Panel Option Package</p> <p>Panel Model: 100kA SCCR</p> <p>Enclosure class: UL Type 12</p> <p>CIM Expansion Card: CIM 200 MODBUS</p> <p>Panel Options Available, without Panel Option Package selected</p> <p>Emergency/Normal Operating Switches (MPC-E & MPC-E(CUE) systems)</p> <p>Surge Protection</p> <p>Pump Run Indicator Lights</p> <p>Alarm Circuit (Panel mounted System Fault Light + Audible Alarm)</p> <p>Side Mount External Service Disconnect Switch 0-30A (0-25Hp) 460/575V</p> <p>Elapsed Time Meter (Digital)</p> <p>Phase Monitor Relay (Includes Circuit Protection)</p>		

Packaged Pump System

Qty	Description	
	<p>VFD Bypass Switch Pump, includes MCP, (MPC-E(CUE) systems)</p> <p>100kA SCCR fault current rating</p> <p>Accessories and Services</p> <p>NSF Approval: NSF61/NSF372 - Drinking Water and Low Lead NOT APPROVED</p> <p>Layout</p> <p>Layout: • Rubber vibration dampers shall be fitted between each pump and baseframe to minimize vibration</p>	

Control Panel

Qty	Description	
1	<p>Hydro MPC system features</p> <p>Pump operation is controlled by CU352 controller, specifically designed to control parallel operation of multiple pumps with the following features/ functions:</p> <ul style="list-style-type: none"> - PID controller with adjustable PI parameters (Kp + Ti) - Constant pressure at setpoint, independent of inlet pressure - Stop function (no flow shutdown) - Automatic cascade control of pumps for optimum efficiency. - Selection of min. time between start/stop, automatic pump changeover and pump priority - Automatic pump test function to prevent idle pumps from seizing up - Standby pump allocation capability - Redundant primary sensor capability - Manual operation - Proportional pressure control - Multi-Sensor zone control with up to six zones • DP SENSORS NEEDED ON ZONES - Differential Pressure/Temperature control using two separate sensors (i.e. discharge - suction subtraction) <ul style="list-style-type: none"> • DP USING IN/OUTLET SENSOR ON MANIFOLDS • DELTA T WILL REQUIRE TEMPERATURE SENSORS (NOT INCL) - Secondary Fall-back sensor will revert to secondary (local) sensor upon primary (remote) sensor failure - Digital Pulse water meter reading (log accumulated flow) - Forced pump changeover - Clock program - Soft pressure build-up - External setpoint influence (via analog input) - Emergency run (via digital input) - Password protection - Possibility of digital remote-control functions (via digital inputs): <ul style="list-style-type: none"> • system on/off • max., min. or user-defined duty • up to 6 alternative setpoints. - Digital inputs and outputs can be configured individually <p>Pump and system monitoring functions:</p> <ul style="list-style-type: none"> - minimum and maximum limits of current value (flow, level, temp., etc.) - built in data logging capability • PC TOOL REQUIRED TO RETREIVE DATA LOG - high system pressure protection - low system pressure protection 	

Control Panel

Qty	Description		
	<ul style="list-style-type: none"> - pump curve data loaded into controller to provide end of curve protection - alarm log with the previous 24 warnings/alarms - potential-free changeover contacts for operation and fault. - Grundfos bus communication with optional gateway connections for all popular communication protocols - Ethernet connection (built-in web server) <p>Pre-fabricated and tested packaged pump system including pumps, piping, and wiring complete with Control MPC</p> <p>ALL MPC SYSTEMS ARE PERFORMANCE AND HYDRO TESTED. IF TEST REPORTS ARE REQUIRED, THEN VERIFIED TESTS NEED TO BE ADDED</p>		

Tanks and Accessories

Qty	Description		
1	<p>Hydro MPC system</p> <p>Accessories and Services</p> <p>Diaphragm Tank Type: Non-code, 150 psig max. working pressure</p> <p>Diaphragm Tank Size: 86 gallon</p> <p>TANK 86GAL ST-210V</p> <p>Recommended Min. Size Tank (GAL): 86</p> <p>Grundfos Tank P/N: 91121896</p> <p>Amtrol Model #: ST-210V</p>		

Grundfos CU 352 Pump Controller

Advanced pump system controller for parallel connected pumps for HVAC and Pressure Boosting Applications



Compatibility

The CU 352 pump controller can control up to six (6) parallel connected pumps in the following manner:

- Direct BUS control: **CRE, CME, VLSE or LCSE** pumps
- Direct BUS control: Pumps with Grundfos **CUE** drives
- Digital/Analog control: Pumps with external drives (requires **IO 351B** Input/Output module)

HVAC Control Modes

- o Constant Differential Pressure control via remote sensor
- Multi-zone Differential Pressure control up to 6 zones
 - Priority, Minimum or Energy Saving Mode
- o Quadratic, proportional or constant differential pressure control via local sensor
 - Adjustable control curve (Max flow and control head)
 - Efficiency based sequencing automatically updated
- o Constant Flow
- o Constant Temperature
- o Constant Differential Temperature

Pressure Boosting Control Modes

- o Constant Pressure (pump discharge)
- o Quadratic or Proportional discharge pressure
 - Adjustable control curve (Max flow and min. static head)
- o Constant Pressure (remote sensor)

Pump Cascade Control

- o Efficiency based pump sequencing
 - * Updated automatically when setpoint and/or control head are changed
- o Automatic Pump alternation (run hour based)
- o Standby Pumps (single or multiple)
- o Adjustable minimum time between starts / stops
- o Adjustable maximum starts per hour
- o Pump test run (exercise idle pumps)
- o Clock program
- o Proportional Gain and Integral Time adjustment

Application optimized functions:

- o Secondary (Fallback) Sensor
- o Pump curve data (5th or 2nd order polynomial)
 - * Pre-programmed from factory
- o Flow estimation via pump curve data and pressure measurement across pump(s)
- o Reduced operation (generator backup power)
 - Max. kW limit or max. number of pumps
- o Specific energy calculation (kWh per unit volume)
 - *requires flow sensor input
- o Low Flow Stop (Pressure Boosting)
 - Adjustable low flow setting: Energy saver mode, medium flow or high comfort level

Protection and Monitoring

- o Check valve failure detection (MLE motors)
- o Pump outside duty range protection
 - *keeps all operating pumps on their curve
- o Low suction pressure warning and alarm
- o Primary sensor failure reaction setting
- o Soft pressure build-up (Pipe fill mode)
- o Low system pressure warning and alarm
- o High system pressure shutdown
- o Alarm log, last 24, time stamped
- o Data log graph (20 - 3600 samples/hour)
 - (Flow, speed, setpoint, sensor feedback, kW)
- o BMS/EMS communication (see page 4)

Page 2

Grundfos CU 352 Pump Controller

CU 352 Control user interface



Status of inputs and outputs

Electrical overview

Shows status of inputs along with wiring landing points [in brackets]

Status	Operation	Alarm	Settings
1.11.1 - Analog inputs			⚙
Analog inputs and measured value			
AI1 (CU 352), [51]		35PSI	
(Diff. pressure, pump, high)		7.9mA	
AI2 (CU 352), [54]		35PSI	
(Diff. pressure, pump, low)		7.9mA	
AI3 (CU 352), [57]		0PSI	
(Diff. pressure, external)		0.0mA	

Status	Operation	Alarm	Settings
1.11.2 - Digital inputs			⚙
DI1 (CU 352), [10]			
(External start/stop)	Active		
DI2 (CU 352), [12]			
(Reduced operation)	Not active		
DI3 (CU 352), [14]			
(Alternative setpoint 2)			
DI1 (IO 351-41), [10]			
(Not used)			

Alarms and warnings

Alarm log - Stores last 24 alarms and warnings.

- > Time event occurred
- > Time event cleared
- > Alarm code for more detailed description.

Status	Operation	Alarm	Settings
3.2 - Alarm log			⚙ ⚠
⚠ AI3-CU352			
Sensor fault (88)			
Occurred at		08/21/2019 10:12 am	
Disappeared at		-- --	
⚠ System			
Water shortage (214)			
Occurred at		08/21/2019 8:54 am	
Disappeared at		08/21/2019 8:55 am	
⚠ System			
Water shortage (214)			
Occurred at		08/21/2019 8:54 am	
Disappeared at		08/21/2019 8:55 am	
⚠ System			
Pumps outside duty range (208)			
Occurred at		08/21/2019 8:54 am	
Disappeared at		08/21/2019 8:54 am	
08/21/2019 10:58 am			

Startup Wizard

Startup Wizard

Step by Step installation guide

- > Set time and date format
- > Remove air/Prime pumps
- > Check pump rotation
- > Set primary sensor

Step-by-step installation guide	
17/26 - Priming sequence	⚙ ⚠
Close the valve on the outlet side of all the pumps. Prime all pumps and make sure that the suction manifold and the suction pipes are primed as well. Make sure that a correctly sized diaphragm tank has been installed, if necessary, and that the tank precharge pressure is correct. Press [ok] to go to the next page.	
Go to next page	➡
08/21/2019 11:13 am	

Grundfos CU 352 Pump Controller

Sequence of operation

Hydronic Circulation

The system controller shall operate equal capacity variable speed pumps to maintain a variable (quadratic or linear) or constant differential pressure. The system controller shall receive an analog signal [4-20mA] from a remote or pump system mounted differential pressure sensor. The controller shall be able to receive a system suction pressure and system discharge pressure to determine the system differential pressure (two independent analog signals). The controller shall have the means to protect pumps against dry running via a user defined low suction pressure setting.

Pressure Boosting

The system controller shall operate equal capacity variable speed pumps to maintain a constant or variable (quadratic or linear) pressure. The system controller shall receive an analog signal [4-20mA] from a remote or pump system mounted pressure sensor. The controller shall be capable of simulating the effect of a remote mounted pressure sensor by quadratically reducing the system discharge pressure setpoint as a function of reduced flow (friction loss compensation).

Cascade Control

Standard Cascade Control (Pumping Efficiency Based):

The pump system controller shall adjust pump speed as necessary to maintain system set-point pressure as flow demand changes. The pump system controller shall start additional pumps upon determination of an increase in efficiency utilizing factory programmed (5th order polynomial) curve data. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional gain and Integral time (PI) settings for system optimization.

Optional Cascade Control (Pump Start Speed Based):

As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach the programable start speed, an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional gain and Integral time (PI) settings for system optimization.

Pumps outside duty range (End of curve protection):

When the pumps are outside their allowable operating range, the controller shall switch on an additional pump, distributing a reduced flow through all pumps in operation moving each pump back into its allowable operating region.

Pump Alternation

All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous with only one pump in operation, the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.

Low Flow Stop (Pressure Boosting)

The system controller shall be capable of detecting low flow allowing for pumps to be switched off in an energy saving mode. Upon detection of low flow, the controller shall increase the system setpoint by 5% (adjustable) to store water in a diaphragm or bladder tank and switch off. The pump shall remain off until the system pressure falls 5% below the system setpoint (adjustable). If system flow is still low when the pump switches back on, the pump shall refill the diaphragm tank to 5% above setpoint and switch off again. If system flow increases above the low flow setting, the pump shall return to normal constant pressure mode maintaining the system setpoint.

Page 3

Grundfos CU 352 Pump Controller

Technical data

Altitude above sea level

Maximum 6,560 feet (2000 m.)

Ambient Temperature

During operation: -4°F to +140°F (-20°C to +60°C)

During transportation: -4°F to +140°F (-20°C to +60°C)

- * At temperatures below 32°F (0°C) the display may react slowly.
- * The display should not be exposed to direct sunlight

Relative air humidity

5 to 95%

Enclosure class

UL type 3R when mounted in the front of a panel with UL type rating 1, 2, 3, 3R, 5, 12, 12K or 13. Overall control panel rating of Type 4/4X available on request.

Supply voltage

1 x 100-240 VAC +/- 10% 50/60Hz, PE
(Class 1 equipment)

Power consumption

Maximum 22 W

Backup battery

The optional backup battery can keep the CU352 powered during intermittent power outages.

The CU 352 will monitor the following:

- short circuit
- wrong polarity
- defective battery
- battery missing
- low battery voltage

Digital inputs (3)

Open-circuit voltage	24 VDC
Closed-circuit current	5 mA, DC
Frequency range	0-4 Hz

Analog inputs (3)

	0-20 mA
Input current and voltage	4-20 mA
	0-10 V
Tolerance	± 3.3 % of full scale
Repetitive accuracy	± 1 % of full scale
Input resistance, current	< 250 Ω
Input resistance, voltage	> 50 kΩ ± 10%
	24 V, 30 mA
Supply to sensor	short-circuit protected

Relay outputs (2)

Normally open contacts	C, NO
Maximum contact load	240 VAC, 2 A
Minimum contact load	5 VDC, 10 mA

Communication protocols

For connection to building management systems, Communication Interface Modules (CIM) can be supplied with the CU 352 controller.

Protocol	CIM Type
LONworks	110
PROFIBUS DP	150
PROFINET IO	500
Modbus RTU	200
Modbus TCP	500
BACnet MS/TP	300
BACnet IP	500
Ethernet IP	500

Grundfos CUE Variable Frequency Drive

The Ultimate in Control



Control Modes:

Grundfos CUE provides a series of pre-defined pumping application control modes

- Constant pressure with or without stop function
- Proportional Differential pressure
- Constant level with or without stop function
- Constant temperature
- Proportional pressure

Intuitive Start Up Guide

Grundfos CUE offers quick and easy set-up. Simply key in application-specific variables such as motor data, pump family, control mode (e.g. constant pressure), sensor type, and setpoint, and the CUE will automatically set all necessary parameters.

Pump Family Settings

Grundfos CUE offers a unique feature using pre-programmed data for different Grundfos pump families. During installation, the correct values are set for minimum speed, maximum speed, ramp times, and other pump specific settings. More than 15 parameters are set to suggested default values when the correct Grundfos pump family is selected during setup.

User-Friendly Functions:

o Start-up Guide

The CUE start-up guide ensures easy installation and commissioning and plug-and-pump convenience. Only a few settings need to be configured on-site by the installer while the rest is either done automatically or preset at the factory.

o Direction of rotation test

The CUE automatically tests and sets the correct direction of rotation without changing the cable connections when a pressure/flow sensor is connected during the startup guide.

o Proportional Pressure

The proportional pressure function will increase local pressure setpoint at higher flows and reduce setpoint at lower flows, according to how the proportional pressure control curve is configured. This function simulates a remoted mounted DP or realitive sensor and compensates for friction loss and saves costs compared to installing remote sensor.

o Stop Function

Stop function is available for constant pressure or constant level applications and stops the pump at low or no flow. Stopping the pump at low flow increases operating efficiency by running more efficient ON/OFF control and using a bladder tank storage during low flow.

o Dry Run Protection

Dry run protection is possible from measurement of variety of dry-running sensors or switch devices.

o Duty/Standby

The duty/standby function is used to alternate between two pumps every 24 hours and if the duty pump is stopped due to an alarm it will alternate operation to standby pump.

o Motor Bearings Supervision

When the bearing monitoring function is active, a warning will appear in the display when the motor bearings are to be relubricated or replaced.

o Over synchronous speed setting

Over synchronous speed is an option for a series of Grundfos pumps in order to extend operating range or reduce physical size of the required pump. Motor and CUE drive should be selected carefully to the actual load in the application.



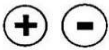
o Standstill heating

When the pump is stopped by a stop command, a current will be applied to the motor windings in order to keep the temperature within the motor above the dewpoint temperature. No external heater is needed.



Grundfos CUE Variable Frequency Drive

Navigating the CUE:

Editing buttons

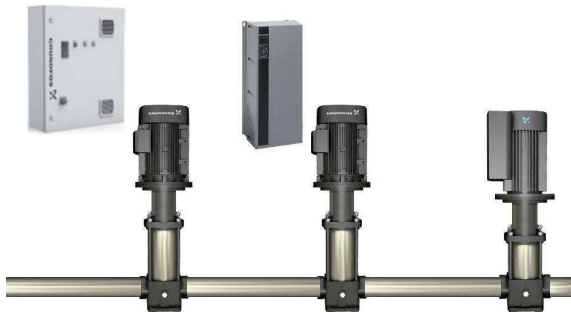
Button	Function
	Makes the pump ready for operation/starts and stops the pump.
	Saves changed values, resets alarms and expands the value field.
	Changes values in the value field.

Navigating buttons

Button	Function
	Navigates from one menu to another. When the menu is changed, the display shown will always be the top display of the new menu.
	Navigates up and down in the individual menu.



Pumps with CUE for variable speed at any location, any pump type



Communication protocols

For connection to building management systems, Communication Interface (CIM/CIU)

Protocol	CIM/CIU Type
LONworks	110
PROFIBUS DP	150
PROFINET IO	500
Modbus RTU	200
Modbus TCP	500
BACnet MS/TP	300
BACnet IP	500

Lower operating cost:

Reacting to system performance data, adjusting to demands for any location, any pump type in e.g. wastewater and raw water intake applications

Less space required:

Smallest enclosed drive solution requires less space and suitable for near-pump installation requirements in all environments and lower CAPEX

Perfectly suited for retrofit applications:

System retrofits to variable speed pumps by adding a wallmount drive to your installation

Easy commissioning:

Control modes are easy to commission, matching the system design criteria, to reduce time with start-up menu.

- Proportional pressure with flow estimation based on simple pump inputs: Hmax, Hnon, Qnom

Grundfos CUE Variable Frequency Drive

Inputs and outputs

Power supply (L1, L2, L3)

Supply voltage	200-240 V \pm 10 %
Supply voltage	380-500 V \pm 10 %
Supply voltage	525-600 V \pm 10 %
Supply voltage	525-690 V \pm 10 %
Supply frequency	50/60 Hz
Maximum temporary imbalance between phases	3 % of rated value
Leakage current to ground	> 3.5 mA
Number of cut-ins, enclosure A	Max. 2 times/min.
Number of cut-ins, enclosures B and C	Max. 1 time/min.
Number of cut-ins, enclosure D	Max. 1 time/2 min.

Note: Do not use the supply voltage for switching the CUE on and off.

Motor output (U, V, W)

Output voltage	0-100 % ¹⁾
Output frequency	0-100 Hz ²⁾
Switching on output	Not recommended

¹⁾ Output voltage in % of supply voltage.

²⁾ Depending on the pump family selected.

RS-485 GENiBus connection

Terminal number	68 (A), 69 (B), 61 GND (Y)
-----------------	----------------------------

The RS-485 circuit is functionally separated from other central circuits and galvanically separated from the supply voltage (PELV).

Digital inputs

Terminal number	18, 19, 32, 33
Voltage level	0-24 VDC
Voltage level, open contact	> 19 VDC
Voltage level, closed contact	< 14 VDC
Maximum voltage on input	28 VDC
Input resistance, R_i	Approx. 4 k Ω

All digital inputs are galvanically separated from the supply voltage (PELV) and other high-voltage terminals.

Signal relays

Relay 01, terminal number	1 (C), 2 (NO), 3 (NC)
Relay 02, terminal number	4 (C), 5 (NO), 6 (NC)
Maximum terminal load (AC-1) ¹⁾	240 VAC, 2 A
Maximum terminal load (AC-15) ¹⁾	240 VAC, 0.2 A
Maximum terminal load (DC-1) ¹⁾	50 VDC, 1 A
Minimum terminal load	24 VDC, 10 mA 24 VAC, 20 mA

¹⁾ IEC 60947, parts 4 and 5.

C: Common

NO: Normally open

NC: Normally closed

The relay contacts are galvanically separated from other circuits by reinforced insulation (PELV).

Analog inputs

Analog input 1, terminal number (external setpoint)	53
Voltage signal	A53 = "U" ¹⁾
Voltage range	0-10 V
Input resistance	Approx. 10 k Ω
Maximum voltage	\pm 20 V
Current signal	A53 = "I" ¹⁾
Current range	0-20, 4-20 mA
Input resistance	Approx. 200 Ω
Maximum current	30 mA
Maximum fault, terminals 53, 54	0.5 % of full scale

Analog input 2, terminal number (sensor 1)	54
Current signal	A54 = "I" ¹⁾
Current range	0-20, 4-20 mA
Input resistance, R_i	Approx. 200 Ω
Maximum current	30 mA
Maximum fault, terminals 53, 54	0.5 % of full scale

¹⁾ The factory setting is voltage signal "U".

All analog inputs are galvanically separated from the supply voltage (PELV) and other high-voltage terminals.

Analog output

Analog output 1, terminal number (sensor 2)	42
Current range	0-20 mA
Maximum load to frame	500 Ω
Maximum fault	0.8 % of full scale

The analog output is galvanically separated from the supply voltage (PELV) and other high-voltage terminals.

Surroundings

Relative humidity	5-95 % RH
Minimum ambient temperature at full operation	32 °F (0 °C)
Minimum ambient temperature at reduced operation	14 °F (-10 °C)
Temperature during storage and transportation	-13 °F to 149 °F (-25 to 65 °C)
Storage duration	Max. 6 months
Maximum altitude above sea level with full performance	3,280 ft (1 km)
Maximum altitude above sea level with performance reduction	6,600 ft (2 km)

CUE, up to 160 amps

Ambient temperature	Max. 122 °F (50 °C)
Average ambient temperature over 24 hours	Max. 113 °F (45 °C)

CUE, 190 amps and above

Ambient temperature	Max. 113 °F (45 °C)
Average ambient temperature over 24 hours	Max. 104 °F (40 °C)

Note: The CUE comes in packaging which is not suitable for outdoor storage.

Grundfos CUE Variable Frequency Drive

Technical data

Power supply 3 x 200-240 V

Typical shaft power P2		Maximum output current [A]	Maximum input current [A]	Enclosure				Efficiency
[Hp]	[kW]	3 x 200-240 V	3 x 200-240 V	IP20	IP21	IP54	IP55	
1	0.75	4.6	4.1	A2	-	-	A4	0.95
1.5	1.1	6.6	5.9		-	-		0.96
2	1.5	7.5	6.8		-	-		0.96
3	2.2	10.6	9.5		-	-		0.96
4	3	12.5	11.3	A3	-	-	A5	0.96
5	3.7	16.7	15		-	-		0.96
7.5	5.5	24.2	22	B3	-	-	B1	0.96
10	7.5	30.8	28		-	-		0.96
15	11	46.2	42		-	-		0.96
20	15	59.4	54	B4	-	-	B2	0.96
25	18.5	74.8	68		-	-		0.96
30	22	88	80	C3	-	-	C1	0.97
40	30	115	104		-	-		0.97
50	37	143	130	C4	-	-	C2	0.97
60	45	170	154		-	-		0.97

Power supply 3 x 380-500 V

Typical shaft power P2		Maximum output current [A]		Maximum input current [A]		Enclosure				Efficiency
[Hp]	[kW]	3 x 380-440 V	3 x 441-500 V	3 x 380-440 V	3 x 441-500 V	IP20	IP21	IP54	IP55	
0.75	0.55	1.8	1.6	1.6	1.4	A2	-	-	A4	0.95
1	0.75	2.4	2.1	2.2	1.9		-	-		0.96
1.5	1.1	3	2.7	2.7	2.7		-	-		0.96
2	1.5	4.1	3.4	3.7	3.1		-	-		0.97
3	2.2	5.6	4.8	5	4.3	A3	-	-	A5	0.97
4	3	7.2	6.3	6.5	5.7		-	-		0.97
5	4	10	8.2	9	7.4		-	-		0.97
7.5	5.5	13	11	11.7	9.9		-	-		0.97
10	7.5	16	14.5	14.4	13	B3	-	-	B1	0.97
15	11	24	21	22	19		-	-		0.98
20	15	32	27	29	25		-	-		0.98
25	18.5	37.5	34	34	31		-	-		0.98
30	22	44	40	40	36	B4	-	-	B2	0.98
40	30	61	52	55	47		-	-		0.98
50	37	73	65	66	59		-	-		0.98
60	45	90	80	82	73		-	-		0.98
75	55	106	105	96	95	C3	-	-	C1	0.98
100	75	147	130	133	118		-	-		0.98
125	90	177	160	161	145	C4	-	-	C2	0.99
150	110	212	190	204	183		-	-		0.98
200	132	260	240	251	231	-	D1h	D1h	-	0.98
250	160	315	302	304	291	-	D2h	D2h	-	0.98
300	200	395	361	381	348	-			-	0.98
350	250	480	443	463	427	-			-	0.98

Grundfos CUE Variable Frequency Drive

Technical data

Power supply 3 x 525-600 V

Typical shaft power P2		Maximum output current [A]		Maximum input current [A]	Enclosure				Efficiency
[Hp]	[kW]	3 x 525-550 V	3 x 550-600 V	3 x 525-600 V	IP20	IP21	IP54	IP55	
1	0.75	1.8	1.7	1.7	A3	-	-	A5	0.97
1.5	1.1	2.6	2.4	2.4		-	-		0.97
2	1.5	2.9	2.7	2.7		-	-		0.97
3	2.2	4.1	3.9	4.1		-	-		0.97
4	3	5.2	4.9	5.2		-	-		0.97
5	4	6.4	6.1	5.8		-	-		0.97
7.5	5.5	9.5	9	8.6		-	-		0.97
10	7.5	11.5	11	10.4		-	-		0.97

Power supply 3 x 525-690 V

UL approval up to 600 VAC power supply

Typical shaft power P2		Maximum output current [A]		Maximum input current [A]		Enclosure				Efficiency
[Hp]	[kW]	3 x 550 V	3 x 575-690 V	3 x 550 V	3 x 575-690 V	IP20	IP21	IP54	IP55	
15	11	14	13	15	15	-	-	-	-	0.98
20	15	19	18	19.5	19.5	-	-	-	-	0.98
25	18.5	23	22	24	24	-	B2	-	B2	0.98
30	22	28	27	29	29	-	-	-	-	0.98
40	30	36	34	36	36	-	-	-	-	0.98
50	37	43	41	49	49	-	-	-	-	0.98
60	45	54	52	59	59	-	-	-	-	0.98
75	55	65	62	71	71	-	C2	-	C2	0.98
100	75	87	83	87	87	-	-	-	-	0.98
125	90	105	100	99	99	-	-	-	-	0.98
150	110	137	131	130	124/128	-	-	-	-	0.98
200	132	162	155	158	151/155	-	D1h	D1h	-	0.98
250	160	201	192	198	189/197	-	-	-	-	0.98
300	200	253	242	245	224/240	-	D2h	D2h	-	0.98
350	250	303	290	299	286/296	-	-	-	-	0.98

Single Phase Input

Power supply 1 x 200-240 V (output 3 x 200-240 V)

Typical shaft power P2		Maximum output current [A]	Maximum input current [A]	Enclosure				Efficiency
[Hp]	[kW]	3 x 200-240 V	1 x 200-240 V	IP20	IP21	IP54	IP55	
1.5	1.1	6.6	12.5	A3	-	-	A5	0.96
2	1.5	7.5	15.0	-	-	-	-	0.96
3	2.2	10.6	20.5	-	B1	-	B1	0.96
4	3	12.5	24	-		-		0.96
5	3.7	16.7	32	-		-		0.96
7.5	5.5	24.2	46	-	B1	-	B1	0.98
10	7.5	30.8	59	-	B2	-	B2	0.98

Grundfos CUE Variable Frequency Drive

Main dimensions and weights (0.75 to 125 hp)

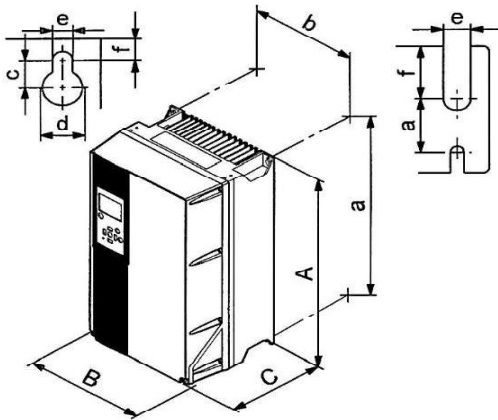


Fig. 53 Standard CUE

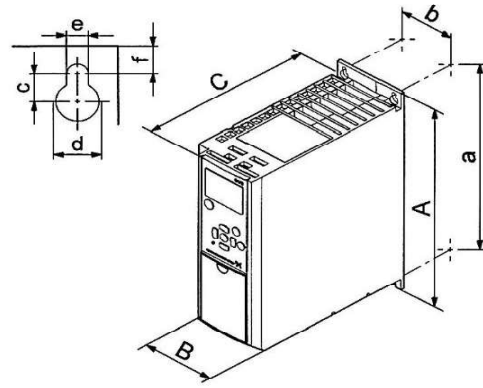


Fig. 54 CUE small

Enclosure	Height [in (mm)] ¹⁾		Width [in (mm)]		Depth [in (mm)]		Screw holes [in (mm)]				Weight [lb (kg)]
	A	a	B	b	C	C ¹⁾	c	Ød	Øe	f	
A2	10.55 (268)	10.12 (257)	3.54 (90)	2.76 (70)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	10.8 (4.9)
with IP21/NEMA1 kit	14.76 (375)	13.78 (350)	3.54 (90)	2.76 (70)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	11.7 (5.3)
A3	10.55 (268)	10.12 (257)	5.12 (130)	4.34 (110)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	14.6 (6.6)
with IP21/NEMA1 kit	14.76 (375)	13.78 (350)	5.12 (130)	4.34 (110)	8.08 (205)	8.62 (219)	.315 (8.0)	.433 (11)	.217 (5.5)	.354 (9.0)	15.4 (7.0)
A4	16.54 (420)	15.79 (401)	7.87 (200)	6.73 (171)	6.89 (175)	6.89 (175)	0.32 (8.2)	0.47 (12)	0.26 (6.5)	0.24 (6)	20.7 (9.4)
A5	16.54 (420)	15.83 (402)	9.53 (242)	8.47 (215)	7.87 (200)	7.87 (200)	.323 (8.2)	.472 (12)	.256 (6.5)	.354 (9.0)	30.9 (14)
B1	18.90 (480)	17.87 (454)	9.53 (242)	8.27 (210)	10.24 (260)	10.24 (260)	.472 (12.0)	.748 (19)	.354 (9.0)	.354 (9.0)	26.5 (12)
B2	25.59 (650)	24.57 (624)	9.53 (242)	8.27 (210)	10.24 (260)	10.24 (260)	.472 (12.0)	.748 (19)	.354 (9.0)	.354 (9.0)	59.5 (27)
B3	15.71 (399)	14.96 (380)	6.50 (165)	5.52 (140)	9.76 (248)	10.32 (262)	.315 (8.0)	.472 (12)	.268 (6.8)	.311 (7.9)	26.5 (12)
with IP21/NEMA1 kit	18.71 (475)	-	6.50 (165)	-	9.80 (249)	10.32 (262)	.315 (8.0)	.472 (12)	.268 (6.8)	.311 (7.9)	-
B4	20.47 (520)	19.49 (495)	9.09 in (231)	7.87 (200)	9.53 (242)	9.53 (242)	-	-	.335 (8.5)	.591 (15.0)	51.8 (23.5)
with IP21/NEMA1 kit	26.38 (670)	-	10.04 (255)	-	9.69 (246)	9.69 (246)	-	-	.335 (8.5)	.591 (15.0)	-
C1	26.77 (680)	25.52 (648)	12.13 in (308)	10.71 (272)	12.21 (310)	12.21 (310)	.472 (12.0)	.748 (19)	.354 (9.0)	.386 (9.8)	99.2 (45)
C2	30.31 (770)	29.09 (739)	14.57 (370)	13.15 (334)	13.19 (335)	13.19 (335)	.472 (12.0)	.748 (19)	.354 (9.0)	.386 (9.8)	143.3 (65)
C3	21.65 (550)	20.51 (521)	12.13 (308)	10.63 (270)	13.11 (333)	13.11 (333)	-	-	.335 (8.5)	.669 (17.0)	77.2 (35)
with IP21/NEMA1 kit	21.65 (755)	-	12.95 (329)	-	13.27 (337)	13.27 (337)	-	-	.335 (8.5)	.669 (17.0)	-
C4	25.98 (660)	24.84 (631)	14.57 (370)	12.99 (330)	13.11 (333)	13.11 (333)	-	-	.335 (8.5)	.669 (17.0)	110.2 (50)
with IP21/NEMA1 kit	37.40 (950)	-	15.39 (391)	-	13.27 (337)	13.27 (337)	-	-	.335 (8.5)	.669 (17.0)	-

Note: Dimensions are maximum height, width, and depth.

¹⁾ Depth with MCB 114 option.

Grundfos CUE Variable Frequency Drive

Main dimensions and weights (150 to 350 hp)

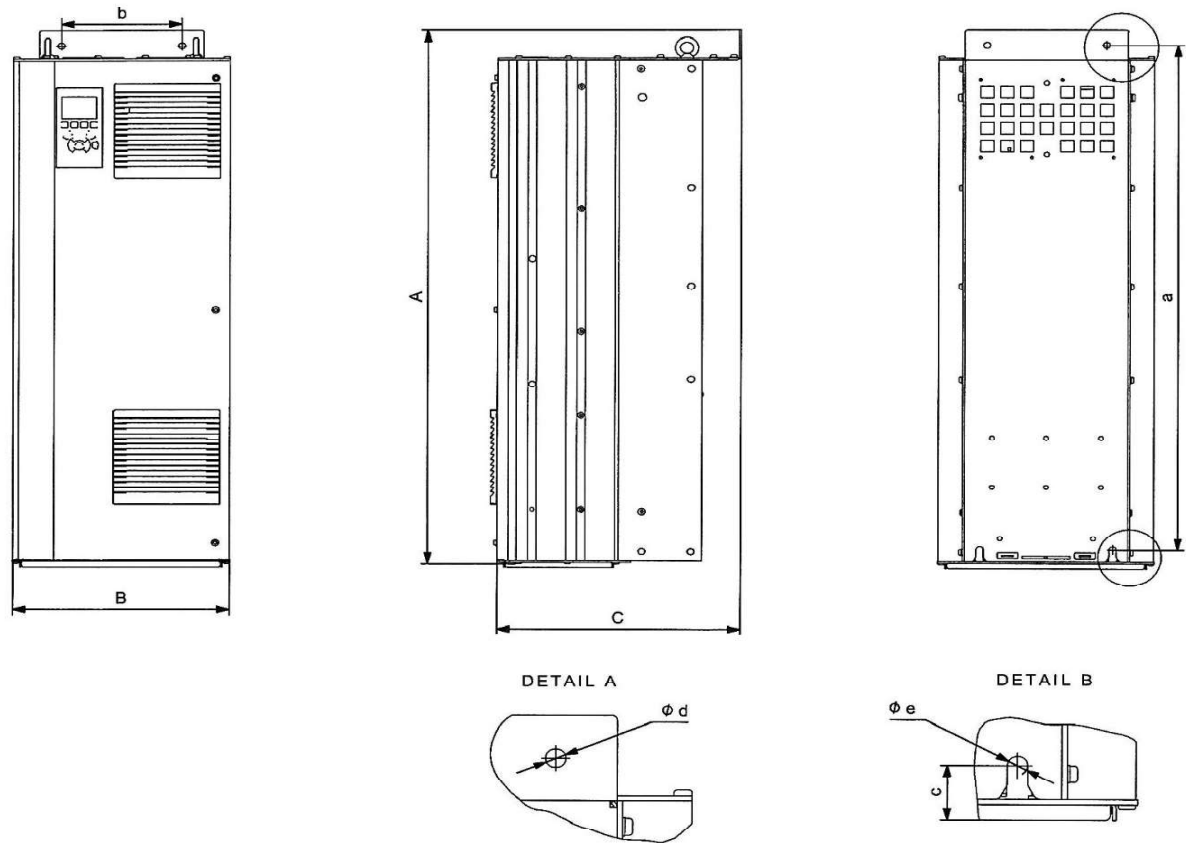


Fig. 52 Enclosures D1h and D2h

Enclosure	Height [in (mm)] ¹⁾		Width [in (mm)]		Depth [in (mm)]		Screw holes [in (mm)]				Weight [lb (kg)]
	A	a	B	b	C	C ¹⁾	c	Ød	Øe	f	
D1h	47.60 (1209)	45.43 (1154)	16.54 (420)	11.97 (304)	14.96 (380)	-	.787 (20)	.433 (11)	.433 (11)	.984 (25)	229.3 (104)
D2h	62.56 (1589)	60.43 (1535)	16.54 (420)	11.97 (304)	14.96 (380)	-	.787 (20)	.433 (11)	.433 (11)	.984 (25)	332.9 (151)

Note: Dimensions are maximum height, width, and depth.

¹⁾ Depth with MCB 114 option.

Shipping dimensions of D1h and D2h: height x width x length = 25.6 x 22.5 x 68.2 in. (650 x 570 x 1730 mm).

TN05 9331 3713

Hydro MPC-E CR (Panel Mount VFD) Guide Specification

Part I – GENERAL

1.1 WORK INCLUDED

- A. Variable Speed Packaged Pumping System

1.2 REFERENCE STANDARDS

The work in this section is subject to the requirements of applicable portions of the following standards:

- A. Hydraulic Institute
- B. ANSI – American National Standards Institute
- C. ASTM – American Society for Testing and Materials
- D. IEEE – Institute of Electrical and Electronics Engineers
- E. NEMA – National Electrical Manufacturers Association
- F. NEC – National Electrical Code
- G. ISO – International Standards Organization
- H. UL – Underwriters Laboratories, Inc.

Part 2 – PRODUCTS

2.1 VARIABLE SPEED PACKAGED PUMPING SYSTEM

- A. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
- B. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the same manufacturer.
- C. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.
- D. The complete packaged pumping system shall be NSF61 / NSF372 Listed for drinking water and low lead requirements.
- E. The packaged pump system shall be ASHRAE 90.1 – 2010 compliant without the need of a remote mounted sensor. The control logic used to simulate a remote mounted sensor shall be proportional pressure control with squared or linear adaptation. An actual flow rate or calculated flow rate based on performance curves (5th order polynomial) loaded into the controller; shall be used to adjust setpoint pressure in proportional pressure control.

2.2 PUMPS

- A. All pumps shall be ANSI NSF 61 / NSF372 Listed for drinking water and low lead requirements.
- B. The pumps shall be of the in-line vertical multi-stage design.
- C. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
- D. Small Vertical In-Line Multi-Stage Pumps (Nominal flow from 3 to 125 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
2. The suction/discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as determined by the pump station manufacturer.
3. Pump Construction.
 - a. Suction/discharge base, pump head, motor stool: Cast iron (Class 30)
 - b. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
 - c. Shaft: 316 or 431 Stainless Steel
 - d. Impeller wear rings: 304 Stainless Steel
 - e. Shaft journals and chamber bearings: Silicon Carbide
 - f. O-rings: EPDM

Shaft couplings for motor flange sizes 184TC and smaller shall be made of cast iron or sintered steel. Shaft couplings for motor flange sizes larger than 184TC shall be made of ductile iron (ASTM 60-40-18).

Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel (ASTM CF-8M) resulting in all wetted parts of stainless steel.

4. The shaft seal shall be a balanced o-ring cartridge type with the following features:
 - a. Collar, Drivers, Spring: 316 Stainless Steel
 - b. Shaft Sleeve, Gland Plate: 316 Stainless Steel
 - c. Stationary Ring: Silicon Carbide
 - d. Rotating Ring: Silicon Carbide
 - e. O-rings: EPDM

The Silicon Carbide shall be imbedded with graphite.

5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. The entire cartridge shaft seal shall be removable as a one piece component. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.
- E. Large (CR32 to CR155) In-line Vertical Multi-Stage Pumps (Nominal flows from 130 to 1070 gallons per minute) shall have the following features:
1. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.
 2. The suction/discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.
 3. Pump Construction.
 - a. Suction/discharge base, pump head: Ductile Iron (ASTM 65-45-12)
 - b. Shaft couplings, flange rings: Ductile Iron (ASTM 65-45-12)
 - b. Shaft: 431 Stainless Steel
 - c. Motor Stool: Cast Iron (ASTM Class 30)
 - d. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel
 - e. Impeller wear rings: 304 Stainless Steel
 - f. Intermediate Bearing Journals: Silicon Carbide
 - g. Intermediate Chamber Bearings: Leadless Tin Bronze
 - h. Chamber Bushings: Graphite Filled PTFE
 - i. O-rings: EPDM

4. The shaft seal shall be a balanced o-ring cartridge type with the following features:

a. Collar, Drivers, Spring:	316 Stainless Steel
b. Shaft Sleeve, Gland Plate:	316 Stainless Steel
c. Stationary Ring:	Silicon Carbide
d. Rotating Ring:	Silicon Carbide
e. O-rings:	EPDM

The Silicon Carbide shall be imbedded with graphite.

5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. The entire cartridge shaft seal shall be removable as a one piece component. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

2.3 VARIABLE FREQUENCY DRIVES (Panel Mount)

- A. The VFD shall convert incoming fixed frequency single-phase or three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform.
- B. The VFD shall include a full-wave diode bridge rectifier and maintain a displacement power factor of near unity regardless of speed and load.
- C. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating.
- D. The VFD shall utilize an output voltage-vector switching algorithm, or equivalent, in both variable and constant torque modes. VFD's that utilize Sine-Coded PWM or Look-up tables shall not be acceptable.
- E. VFD shall automatically boost power factor at lower speeds.
- F. The VFD shall be able to provide its full rated output current continuously at 110% of rated current for 60 seconds.
- G. An empty pipe fill mode shall be available to fill an empty pipe in a short period of time, and then revert to the PID controller for stable operation.
- H. Switching of the input power to the VFD shall be possible without interlocks or damage to the VFD at a minimum interval of 2 minutes.
- I. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks.
- J. The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life.
- K. VFD shall provide full torque to the motor given input voltage fluctuations of up to +10% to -15% of the rated input voltage.

L. The VFD shall provide internal DC link reactors to minimize power line harmonics and to provide near unity power factor. VFD's without a DC link reactor shall provide a 5% impedance line side reactor.

M. VFD to be provided with the following protective features:

1. VFD shall have input surge protection utilizing MOV's, spark gaps, and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec.
2. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD.
3. VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
4. VFD shall auto-derate the output voltage and frequency to the motor in the presence of sustained ambient temperatures higher than the normal operating range, so as not to trip on an inverter temperature fault. The use of this feature shall be user-selectable and a warning will be exported during the event. Function shall reduce switching frequency before reducing motor speed.
5. VFD shall auto-derate the output frequency by limiting the output current before allowing the VFD to trip on overload. Speed can be reduced, but not stopped.
6. The VFD shall have the option of an integral RFI filter. VFD enclosures shall be made of metal to minimize RFI and provide immunity.

N. VFD to be provided with the following interface features:

1. VFD shall provide an alphanumeric backlit display keypad, which may be remotely mounted using standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD.
2. VFD shall display all faults in plain text; VFD's, which can display only fault codes, are not acceptable.
3. All VFD's shall be of the same series, and shall utilize a common control card and LCP (keypad/display unit) throughout the rating range. The control cards and keypads shall be interchangeable through the entire range of drives used on the project.
4. VFD keypad shall be capable of storing drive parameter values in non-volatile RAM uploaded to it from the VFD, and shall be capable of downloading stored values to the VFD to facilitate programming of multiple drives in similar applications, or as a means of backing up the programmed parameters.
5. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
6. A start guide menu with factory preset typical parameters shall be provided on the VFD to facilitate commissioning.
7. VFD shall provide full galvanic isolation with suitable potential separation from the power sources (control, signal, and power circuitry within the drive) to ensure compliance with PELV requirements and to protect PLC's and other connected equipment from power surges and spikes.
8. All inputs and outputs shall be optically isolated. Isolation boards between the VFD and external control devices shall not be required.

9. There shall be three programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. An additional digital input is preprogrammed for start/stop.
10. The VFD shall have two analog signal inputs. One dedicated for sensor input and one for external set point input.
11. One programmable analog output shall be provided for indication of a drive status.
12. The VFD shall provide two user programmable relays with selectable functions. Two form 'C' 230VAC/2A rated dry contact relay outputs shall be provided.
13. The VFD shall store in memory the last 5 faults with time stamp and recorded data.
14. The VFD shall be equipped with a standard RS-485 serial communications port for communication to the multi-pump controller. The bus communication protocol for the VFD shall be the same as the controller protocol.

O. VFD service conditions:

1. Ambient temperature operating range, -10 to 45°C (14 to 113°F) Continuous; 50 °C max temperature Intermittent.
2. 0 to 95% relative humidity, non-condensing.
3. Elevation to 1000 meters (3,300 feet) without derating.
4. VFD's shall be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -15% variations. Line frequency variation of $\pm 2\%$ shall be acceptable.
5. No side clearance shall be required for cooling of the units.

2.4 FIXED SPEED MOTORS

- A. Fixed Speed Motors are to be provided with the following basic features:
1. Designed for continuous duty operation, NEMA design B with a 1.15 service factor.
 2. Totally Enclosed Fan Cooled or Open Drip Proof with Class F insulation.
 3. Nameplate shall have, as a minimum, all information as described in NEMA Standard MG 1-20.40.1.
 4. Motors shall have a NEMA C-Flange for vertical mounting.
 5. Drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump.

2.5 PUMP SYSTEM CONTROLLER

- A. The pump system controller shall be a standard product developed and supported by the pump manufacturer.
- B. The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller user interface shall have a color display with a minimum screen size of 3-1/2" x 4-5/8" for easy viewing of system status parameters and for field

programming. The display shall have a back light with contrast adjustment. Password protection of system settings shall be standard.

- C. Galvanic Isolation: The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.
- D. Backup Battery: The controller shall have the ability to be connected to a backup battery to supply power to the controller during periods of loss of supply power.
- E. Home Status Screen: The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
- Current value of the control parameter, (typically differential pressure)
 - Most recent existing alarm (if any)
 - System status with current operating mode
 - Status of each pump with current operating mode and rotational speed as a percentage (%)
 - Estimated flow-rate, (or actual flow if flow sensor is used)
 - One user defined measured parameter (i.e. power consumption)
- F. Inputs/Outputs: The controller shall have as a minimum the following hardware inputs and outputs:
- Three analog inputs (4-20mA or 0-10VDC)
 - Three digital inputs
 - Two digital outputs
 - Ethernet connection (built-in web server)
 - Field Service connection to PC for advanced programming, software and/or firmware upgrades and data logging
- G. Pump system programming: As a minimum, the following parameters shall be available and/or field adjustable:
- Sensor Settings: Suction, Discharge, Differential Pressure [analog supply/range]
 - PI Controller: Proportional gain (Kp) and Integral time (Ti)
 - Low suction: Pressure/level shutdown via digital contact
 - Limit Exceeding function: For low system, low suction warnings and shut down [via analog input]
 - Flow meter settings (if used, analog signal)
- H. Pump Curve Data: The actual pump performance curves (5th order polynomial) shall be loaded (software) into the pump system controller. Pump curve data shall be used for the following:
- a. Display and data logging of calculated flow rate
 - b. Variable pressure control (quadratic or proportional)
 - c. Pump outside of duty range protection
 - d. Sequence pumps based on efficiency
- I. Variable Pressure Control: The controller shall have variable pressure control to compensate for pipe friction loss by decreasing the pressure set-point at lower flow-rates and increasing the pressure set-point at higher flow-rates by using the actual flow rate or calculated flow rate. Variable pressure control that uses power consumption and speed only shall not be considered equal to variable pressure control that uses actual differential pressure measurement along with pump power and speed.
- J. Multi-Sensor: The controller shall be able to control using up to six differential pressure (DP) sensors (zones). Each zone shall have a programmable maximum and minimum DP range. The controller shall be capable of an energy optimal mode where pump speed/energy shall be reduced until any of the zones reach the minimum DP setting.

- K. Check Valve Failure Detection (Systems with integrated VFD motors): The system controller shall be able to detect motors turning in the opposite direction and give check valve failure notification.
1. For minor leaks the pump shall start with a warning indicated
 2. For major leaks the pump shall remain off to prevent damage with an alarm indication
- L. Pulse flow meter: The system controller shall be able to receive pulse readings from a digital pulse meter and log/display accumulated flow.
- M. DP Subtraction: The system controller shall be able to control off subtraction of two pressure or temperature sensors for differential pressure or differential temperature control.
- N. Programmable Setpoints: The system controller shall be able to accept up to seven programmable set-points via a digital input, (additional input/output module may be required).
- O. Setpoint Influence: The system pressure set-point shall be capable of being automatically adjusted by using an external set-point influence. The set-point influence function enables the user to adjust the control parameter (typically differential pressure) by measuring an additional parameter. (Example: Lower the system differential pressure set-point based on a flow or outdoor temperature measurement).
- P. Remote Control: The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.
- Q. Setpoint Ramp: The controller shall be able to adjust the ramp time of a change in set point (increase and decrease).
- R. Warnings and Alarms: The pump system controller shall store up to 24 warnings and alarms in memory. The time, date and duration of each alarm shall be recorded. A potential-free relay shall be provided for alarm notification to the building management system. The controller shall display the following alarm conditions:
- | | |
|--|---------------------------------|
| Individual pump failure | Check valve failure |
| VFD trip/failure | Loss of sensor signal (4-20 mA) |
| Loss of remote set-point signal (4-20mA) | External Fault |
| Pump outside of duty range | Limit 1 and 2 exceeded* |
- *The controller shall be capable of monitoring two analog signals (i.e. suction pressure and discharge pressure) for additional pump or system protection.
- S. Built-in data log: The controller shall have built-in data logging capability. Logged values shall be graphically displayed on the controller and shall be downloadable to a notebook/pc as a delimited text file. A minimum of 7200 samples per logged value shall be available for the following parameters:
- Estimated flow-rate (or actual flow if flow sensor is connected)
 - Speed of pumps
 - Process Value/sensor feedback (usually differential pressure)
 - Power consumption
 - Controlling parameter (setpoint)
 - Inlet pressure (when remote differential pressure is the primary sensor)
- T. Redundant Primary Sensor: The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor.
- U. Secondary Sensor: Upon loss of signal from the remote sensor, the controller shall be capable of reverting control to the pump system mounted sensors with a programmable setpoint. The

pumps shall maintain a constant, proportional or quadratic pressure across the system until the remote setpoint signal is restored.

- V. Pump Test: The controller shall have a pump “Test Run” feature such that pumps are switched on during periods of inactivity (system is switched to the “off” position but with electricity supply still connected). The inoperative pumps shall be switched on for a period of three to four seconds every 24 hours, 48 hours or once per week and at a programmable time of day.
- W. Reduced Operation: During backup generator operation, the controller shall be capable of reducing the power consumed by the pump system by either limiting the number of pumps in operation or by limiting the amount of power consumption (kW). The controller shall receive a digital input indicating backup generator operation.
- X. Power and Energy Consumption: The controller shall be capable of displaying instantaneous power consumption (Watts or kilowatts) and cumulative energy consumption (kilowatt-hours).
- Y. Specific Energy: When a flow sensor is connected, the controller shall be capable of displaying instantaneous specific energy in Watt-hours per gallon (Wh/gal) or Watt-hours per 1,000 gallons (Wh/kgal).
- Z. Built-in Ethernet: The controller shall have an Ethernet connection with a built-in web server allowing for connection to a building computer network with read/write access to the controller via a web browser.
- AA. Service Contact Information: The controller shall have a programmable Service Contact Field that can be populated with service contact information including: contact name, address, phone number(s) and website.

2.6 CONTROL PANEL

SCCR: The complete control panel assembly shall have a Short Circuit Current Rating of 100 kA

BMS Integration: Standard shall be BACnet MS/TP

*Other protocols available: BACnet IP, Ethernet IP, Modbus RTU,
Modbus TCP, LON

The pump system controller shall be mounted in a UL Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire UL Type 3R control panel shall be UL 508 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions. The control panel shall include the following:

- 80 dB System Fault Audible Alarm with push button to silence
- Emergency/Normal Operation Switches (Control bypass)
- Individual Service Disconnect Switches (accessible outside of panel)
- Pump Run Lights
- System Fault Light
- Surge Arrestor

2.7 SEQUENCE OF OPERATION

The system controller shall operate equal capacity variable speed pumps to maintain a constant differential pressure (system set-point from remote DP sensor) or proportional pressure differential pressure setpoint (system setpoint from local mounted sensor(s)), depending on the application. The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer on the discharge and suction manifolds, indicating the actual

system pressure and inlet pressure. The controller shall be capable of controlling off the subtraction of discharge minus suction transducers for differential pressure across the manifolds.

A. Standard Cascade Control (Pumping Efficiency Based):

The pump system controller shall adjust pump speed as necessary to maintain system set-point pressure as flow demand increases. Utilizing the pump curve information (5th order polynomial), the pump system controller shall stage on additional pumps when pump hydraulic efficiency will be higher with additional pumps in operation. Exception: When the flow and head are outside the operating pump(s) allowable operating range the controller shall switch on an additional pump thus distributing flow and allowing all pump(s) to operate in allowable operating range. When the system pressure is equal to the system set-point, all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional Gain and Integral time (PI) settings for system optimization.

Optional Cascade Control (Pump Start Speed Based):

As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach 96% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point all pumps in operation shall reach equal operating speeds. The pump system controller shall have field adjustable Proportional Gain and Integral time (PI) settings for system optimization.

- B. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.
- C. All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.
- D. The system controller shall be able to control a pressure maintenance pump, (jockey pump), in the system in pressure boosting applications. The set point of the pressure maintenance pump shall be able to be any value above or below the pump system's set point. The pressure maintenance pump shall be able to be staged on as back-up pump when capacity of pump system is exceeded.

2.8 LOW FLOW STOP FUNCTION (Constant Pressure Applications)

The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable and shall not be used.

Standard Low Flow Stop and Energy Saving Mode

If a low or no flow shut-down is required (periods of low or zero demand) a bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band, adjustable). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band, adjustable). Upon low flow shut-down a pump shall be restarted in one of the following two ways:

- A. Low Flow Restart: If the low flow condition still exists, the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.

- B. Normal Flow Restart: If the pump system controller determines a low flow condition no longer exists the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.

[OPTIONAL] Low Flow Stop and Energy Saving Mode

The pump system controller shall be capable receiving a digital signal from a flow switch or an analog signal from a flow meter to indicate a low flow condition. A bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When low flow is detected (signal from flow switch or meter), the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band). The pump shall remain in the energy saving on/off mode during low flow indication. When low flow is no longer present (low flow indication ceases), the pump(s) shall resume constant pressure operation.

It shall be possible to change from the standard low flow stop to the optional low flow stop (and vice-versa) via the user interface.

2.9 SYSTEM CONSTRUCTION

- A. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation cannot exist in manifold during operation to prevent bacteria growth inside manifold.
- B. The suction and discharge manifolds material shall be 316 stainless steel. Manifold connection sizes shall be as follows:
 - 3 inch and smaller: Male NPT threaded
 - 4 inch through 8 inch: ANSI Class 150 rotating flanges
 - 10 inch and larger: ANSI Class 150 flanges
- C. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
- D. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
- E. For systems that require a diaphragm tank, a connection of no smaller than 3/4" shall be provided on the discharge manifold.
- F. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with

hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.

- G. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
- H. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.
- I. The base frame shall be constructed of corrosion resistant 304 stainless steel for systems with CR pump sizes up to CR64. The pump system base shall be powder coated white aluminum RAL9006, carbon steel ASTM A36 structural steel, for systems with CR95 and larger pumps.
- J. Rubber vibration dampeners shall be fitted between each pumps and base frame to minimize vibration.
- K. Depending on the system size and configuration, the control panel shall be mounted in one of the following ways:

- On a 304 stainless steel fabricated control cabinet stand attached to the system skid.
 - On a 304 stainless steel fabricated skid, separate from the main system skid
 - On its own base (floor mounted with plinth)

2.10 TESTING

- A. The tester used for testing the pump system shall be constructed and calibrated according to the requirements of hydraulic test standard ISO 9906.
- B. The entire pump station shall as a minimum be factory tested for functionality and documented results of functionality test supplied with pump station.

Functionality testing shall include the following parameters:

- 1. Complete System Hydrostatic Test – 1.5 times the nameplate maximum pressure
 - 2. No-Flow Detection Shutoff Test
 - 3. Water Shortage Test
 - 4. Two-Point Setpoint Performance Test.
- C. Water used for testing shall be treated with three different filtration systems to ensure only clean water is used for testing pump station.
 - 1. 25 micron mechanical filter – removes solid parts from water
 - 2. Activated carbon filter – keeps water clear and eliminates odor
 - 3. Ultraviolet light system – kills all bacteria growth
- D. Optional performance testing shall include: (Select one)
 - 1. 10-Point Verified Performance Test
 - 2. Witnessed Verified Performance Test

2.11 WARRANTY

- A. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

Grundfos Warranty Policy U.S.

The Grundfos warranty covers that the products are not defective due to material nor workmanship.

For Grundfos manufactured products, the warranty covers a standard period of no more than 30 months from the date of manufacture. For PACO, Yeomans, Chicago Pump, Morris, and Sewer Chewer manufactured products, the warranty covers a standard period of no more than 18 months from shipment date. If the pump is installed or commissioned by Grundfos or Grundfos Authorized Service Partners, then the warranty period will cover 24 months from installed date for Grundfos manufactured products and 12 months for PACO, Yeomans, Chicago Pump, Morris, and Sewer Chewer manufactured products (proper startup or commission data required).

Grundfos will determine to repair or replace based on its costs. The parts will be replaced free of charge, but the cost of transport to and from the place of delivery as well as any costs for uninstallations or reinstallations shall be absorbed by the purchaser of the product.

Grundfos reserves the right to extend our service partner network of choice, depending on product range. It is very important the Grundfos warranty does not cover loss of profit, business, or any indirect or consequential damage of any kind whatsoever. Products sold but not manufactured by Grundfos are subject to the warranty granted by the manufacturer of said products and not by Grundfos warranty (i.e. Baldor motors).

Grundfos will not be responsible for system design faults, pump seized due to system deposits, nor damaged packaging. Grundfos will not be responsible for the damage or wear of its products caused by abnormal operating conditions, accidents, abuse, misuse, alterations, unauthorized repairs, or if the product was not installed according to the Installation Instructions and Operation issued by Grundfos. Grundfos will not be responsible for damages nor losses resulting from the use or operation of the product and are not liable for any consequential losses. Wearable parts will not be covered under warranty for normal wear, or misapplication. Wearable parts include mechanical seals and wear rings. Mechanical Seals are NOT warranted beyond 24 hours from time of factory startup.

To obtain warranty, the defective product must be returned to a Grundfos product distributor from which it was purchased together with the proof of purchase, installation date, failure date, and any other installation support data. Unless otherwise specified, the distributor or dealer will contact Grundfos or an authorized service partner to request instructions. Any defective product to be returned to Grundfos or to an authorized service partner must be sent with freight from customer, with the documentation that supports the warranty claim, as well as an authorization for the return of materials (RMA) issued by Grundfos.

Grundfos reserves the right to complete an on-site visit to diagnose in accordance with customer acceptance. This determination includes, but is not limited to, the size of the pump, the application (essential business), and/or the criticality of the operations. If warranty applies, then travel and expenses will be covered under warranty. If it is determined to not be warranty, then travel, expenses, and labor will be charged at the customer's expense.

Products that have been exposed to radioactive materials will not be accepted in return by Grundfos. Those products exposed to toxic materials or were in a mining application require 3 forms: (1) Decontamination, (2) Certificate of Cleanliness (COC), and (3) MSDS / SDS Forms. The warranty claim in this case must be processed with the dealer from which it was purchased. For non-potable, only (2) COC is required.

TAB3 - Additional Accessories

TAB 3

Additional Accessories

-Common to both options

Brass Boiler Drain

Threaded Male Connection • 125 WOG



T-621

Features

- Manufactured in ISO-9001 facility
- 3/4" hose thread outlet

Approvals

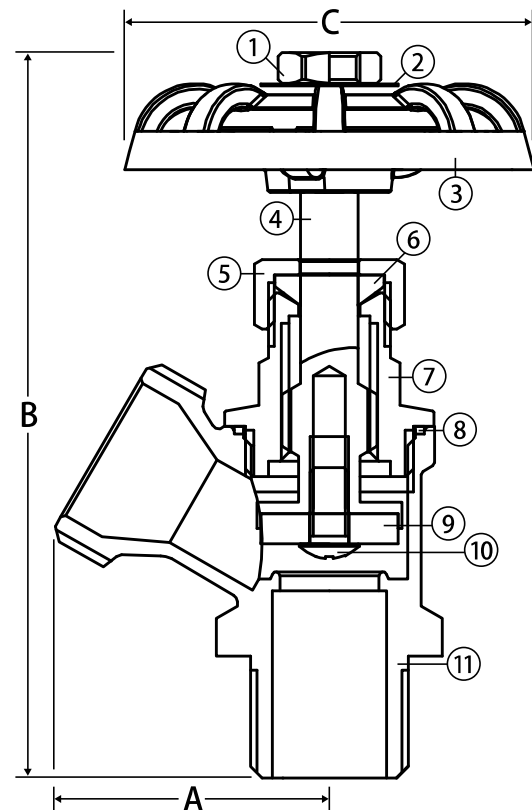
- ANSI B1.20.1
- ANSI B1.20.7

• Pressure Rating

- 125 WOG



WARNING: This product can expose you to chemicals including lead, which is known to the State of California to cause cancer, and lead, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.



Material Specifications

No.	Part	Materials
1	Handle Nut	SS304 Stainless Steel
2	Name Plate	Aluminum
3	Hand Wheel	Cast Iron
4	Stem	Brass - C46500
5	Packing Nut	Brass - C37700
6	Gland Packing	PTFE
7	Bonnet	Cast Brass - C46500
8	Gasket	PTFE
9	Seat Packing	EPDM
10	Seat Screw	SS304 Stainless Steel
11	Body	Brass - C46500

Dimensions

Part No.	Size	A	B	C
201-003	1/2"	1.58	3.59	2.13
201-004	3/4"	1.58	3.70	2.13

Flow Measurement

SITRANS F M

Flow sensor MAG 5100 W

Overview



The SITRANS F M MAG 5100 W is an electromagnetic flow sensor designed to meet ground water, drinking water, waste water, sewage or sludge applications.

Benefits

- DN 15 to DN 1200/2000 (½" to 48"/78")
- Stock program of MAG 5100 W secures short delivery time
- Connection flanges EN 1092-1 (DIN 2501), ANSI, AWWA, AS and JIS.
- NBR Hard Rubber and Ebonite Hard Rubber liner for all water applications
- EPDM liner with drinking water approvals
- Hastelloy integrated grounding and measuring electrodes
- Increased low flow accuracy for water leak detection, due to coned liner design.
- Drinking water approvals
- Suitable for direct burial and constant flooding
- Custody transfer approvals
- Built-in length according to ISO 13359; the standard includes sizes up to DN 400.
- Easy commissioning, SENSORPROM unit automatically uploads calibration values and settings.
- Designed so patented in-situ verification can be conducted. Using SENSORPROM fingerprint.
- Custody transfer option for water billing, with type approval after OIML R 49 and verified according to MI-001 - OD inlet/OD outlet installation
 - Pattern approval OIML R 49
 - Conform to ISO 4064 and EN 14154 for mechanical flowmeters
 - PTB K7.2
 - Kiwa water approval
- FM Fire Service Meter (Class Number 1044) for automatic fire protection systems
- Meets EEC directives: PED 2014/68/EU pressure directive for EN1092-1 flanges
- Simple onsite or factory upgrade to IP68/NEMA 6P of a standard sensor
- Type approval of marine equipment (ABS, Bureau Veritas, DNV, GL, Lloyd's Register)

Application

The main applications of the SITRANS F M electromagnetic flow sensors can be found in the following fields:

- Water abstraction
- Water treatment
- Water distribution network (leak detection management)
- Custody transfer water meters
- Irrigation
- Waste water treatment
- Filtration plant (e.g. reverse osmosis and ultra filtration)
- Industrial water applications

Mode of operation

The flow measuring principle is based on Faradays law of electromagnetic induction according to which the sensor converts the flow into an electrical voltage proportional to the velocity of the flow.

Integration

The complete flowmeter consists of a flow sensor and an associated transmitter SITRANS F M MAG 5000, MAG 6000 or MAG 6000 I.

The flexible communication concept USM II simplifies integration and update to a variety of fieldbus systems, e.g. HART, DeviceNet, PROFIBUS DP and PA, FOUNDATION Fieldbus H1 or Modbus RTU/RS 485.

Technical specifications

Product characteristic	MAG 5100 W (7ME6520) Mainly for the European market EPDM or NBR lining	MAG 5100 W (7ME6580) Mainly for the non-European market Ebonite lining
Design and nominal size	Coned sensor (octagon liner): DN 15 ... 40 (½" ... 1½") Coned sensor: DN 50 ... 300 (2" ... 12") Full bore sensor: DN 350 ... 1200 (14" ... 48")	Full bore sensor: DN 25 ... 2000 (1" ... 78")
Measuring principle	Electromagnetic induction	Electromagnetic induction
Excitation frequency (Mains supply: 50/60 Hz)	DN 15 ... 65 (½" ... 2½"): 12.5 Hz/15 Hz DN 80 ... 150 (3" ... 6"): 6.25 Hz/7.5 Hz DN 200 ... 300 (8" ... 12"): 3.125 Hz/3.75 Hz DN 350 ... 1200 (14" ... 48"): 1.5625 Hz/1.875 Hz	DN 25 ... 65 (1" ... 2½"): 12.5 Hz/15 Hz DN 80 ... 150 (3" ... 6"): 6.25 Hz/7.5 Hz DN 200 ... 1200 (8" ... 48"): 3.125 Hz/3.75 Hz DN 1400 ... 2000 (54" ... 78"): 1.5625 Hz/1.875 Hz
Process connection		
Flanges ¹⁾		
• EN 1092-1	PN 10 (145 psi): DN 200 ... 300 (8" ... 12") Flat face PN 10 (145 psi): DN 350 ... 1200 (14" ... 48") Raised face ²⁾ PN 16 (232 psi): DN 50 ... 300 (2" ... 12") Flat face ³⁾ PN 16 (232 psi): DN 350 ... 1200 (14" ... 48") Raised face PN 40 (580 psi): DN 15 ... 40 (½" ... 1½") Flat face	Raised face ³⁾ (EN 1092-1, DIN 2501 and BS 4504 have the same mating dimensions) PN 6 (87 psi): DN 1400 ... 2000 (54" ... 78") PN 10 (145 psi): DN 200 ... 2000 (8" ... 78") PN 16 (232 psi): DN 65 ... 600 (2½" ... 24") PN 40 (580 psi): DN 25 ... 50 (1" ... 2")
• ANSI B16.5	Class 150: ½" ... 12" Flat face; 14" ... 24" Raised face	Class 150: 1" ... 24"; Raised face
• AWWA C-207	Class D: 28" ... 48", Flat face	Class D: 28" ... 78", Flat face
• AS4087	PN 16 (232 psi): DN 15 ... DN 300 (2" ... 12") Flat Face; DN 350 ... DN 1200 (14" ... 48") Raised face	PN 16 (232 psi): DN 50 ... DN 1200 (2" ... 48") Raised face
• JIS B 2220:2004	-	K 10 (1" ... 24")
Rated Operation conditions		
Ambient temperature		
• Sensor	-40 ... +70 °C (-40 ... +158 °F)	-20 ... +70 °C (-4 ... +158 °F)
• Compact with transmitter MAG 5000/6000 ⁴⁾	-20 ... +60 °C (-4 ... +140 °F)	-20 ... +60 °C (-4 ... +140 °F)
Operating pressure (Abs) [abs. bar] (Maximum operating pressure depending on flange standard, decreases with increasing operating temperature)	DN 15 ... 40 (½" ... 1½"): 0.01 ... 40 bar (0.15 ... 580 psi) DN 50 ... 300 (2" ... 12"): 0.03 ... 20 bar (0.44 ... 290 psi) DN 350 ... 1200 (14" ... 48"): 0.01 ... 16 bar (0.15 ... 232 psi)	DN 25 ... 50 (1" ... 2"): 0.01 ... 40 bar (0.15 ... 580 psi) DN 65 ... 1200 (2½" ... 48"): 0.01 ... 16 bar (0.15 ... 232 psi) DN 1400 ... 2000 (54" ... 78"): 0.01 ... 10 bar (0.15 ... 145 psi)
Enclosure rating		
• Standard	IP67 to EN 60529/NEMA 4X/6 (1 mH ₂ O for 30 min)	IP67 to EN 60529/NEMA 4X/6 (1 mH ₂ O for 30 min)
• Option	IP68 to EN 60529/NEMA 6P (10 mH ₂ O continuously)	IP68 to EN 60529/NEMA 6P (10 mH ₂ O continuously)
Pressure drop	DN 15 and 25 (½" and 1"): Max. 20 mbar (0.29 psi) at 1 m/s (3 ft/s). DN 40 ... 300 (1½" ... 12"): Max 25 mbar (0.36 psi) at 3 m/s (10 ft/s) DN 350 ... 1200 (14" ... 48"): Insignificant	Insignificant
Test pressure	1.5 x PN (where applicable) FM Fire Service: 2 x PN	1.5 x PN (where applicable)
Mechanical load (vibration)	18 ... 1000 Hz random in x, y, z, directions for 2 hours according to EN 60068-2-36 Sensor: 3.17 g RMS Sensor with compact MAG 5000/6000 mounted transmitter: 3.17 g RMS Sensor with compact MAG 6000 I mounted transmitter: 1.14 g RMS	18 ... 1000 Hz random in x, y, z, directions for 2 hours according to EN 60068-2-36 Sensor: 3.17 g RMS Sensor with compact MAG 5000/6000 mounted transmitter: 3.17 g RMS Sensor with compact MAG 6000 I mounted transmitter: 1.14 g RMS

Flow Measurement

SITRANS F M

Flow sensor MAG 5100 W

Product characteristic	Mainly for the European market (7ME6520) EPDM or NBR lining	Mainly for the non-European market (7ME6580) Ebonite lining
<u>Medium conditions</u>		
Temperature of medium		
• NBR	-10 ... +70 °C (14 ... 158 °F)	-
• EPDM	-10 ... +70 °C (14 ... 158 °F)	-
• EPDM/NBR (MI-001)	0.1 ... 30 °C (32 ... 76 °F)	-
• Ebonite	-	-10 ... +70 °C (14 ... 158 °F)
EMC	2014/30/EU	2014/30/EU
Design		
Material		
• Housing and flanges	Carbon steel ASTM A 105, with corrosion-resistant coating Corrosivity category C4M, according to ISO 12944-2	Carbon steel ASTM A 105, with corrosion-resistant coating Corrosivity category C4M, according to ISO 12944-2
• Electrode	Hastelloy C276	Hastelloy C276
• Grounding electrode	Hastelloy C276	Hastelloy C276
• Terminal box	Fibre glass reinforced polyamide	Fibre glass reinforced polyamide
Certificates and approvals		
Calibration		
• Standard production calibration	Zero-point, 2 x 25 % and 2 x 90 %	Zero-point, 2 x 25 % and 2 x 90 %
• Special calibration	5-point calibration: 20 %, 40 %, 60 %, 80 %, 100 % of factory Q _{max} 10-point calibration: ascending and descending at 20 %, 40 %, 60 %, 80 %, 100 % of factory Q _{max} Matched-pair calibration: default, 5-point or 10-point	5-point calibration: 20 %, 40 %, 60 %, 80 %, 100 % of factory Q _{max} 10-point calibration: ascending and descending at 20 %, 40 %, 60 %, 80 %, 100 % of factory Q _{max} Matched-pair calibration: default, 5-point or 10-point
Custody transfer	<ul style="list-style-type: none"> MI-001 cold water (EU): DN 50 ... DN 1200 (2" ... 48") Kiwa water approval (NL): DN 50 ... DN 1200 (2" ... 48") Chilled water pattern approval PTB K 7.2 DN 50 ... DN 300 (Germany)⁵⁾ 	-
Drinking water	EPDM liner: <ul style="list-style-type: none"> WRAS (WRc, BS690 cold water, GB) NSF/ANSI Standard 61⁶⁾ (Cold water, US) ACS listed (F) DVGW W270 (D) Belgaqua (B) MCERTS (GB environmental) 	<ul style="list-style-type: none"> WRAS (WRc, BS690 cold water, GB) NSF/ANSI Standard 61⁶⁾ (Cold water, US)
Marine ⁷⁾	<ul style="list-style-type: none"> American Bureau of Shipping (ABS) Bureau Veritas Det Norske Veritas (DNV) Germanischer Lloyd (GL) Lloyd's Register of Shipping 	
Hazardous areas ⁸⁾		
• Standard sensor with/without MAG 5000/6000/6000 I	<ul style="list-style-type: none"> FM - NI Class I Div. 2 Groups A, B, C, D - NI Class I Zone 2 Groups IIC 	<ul style="list-style-type: none"> FM - NI Class I Div. 2 Groups A, B, C, D - NI Class I Zone 2 Groups IIC
Pressure equipment	<ul style="list-style-type: none"> PED conforming: All EN1092-1 flanges and ANSI Class 150 (< DN 300 /<12") – 2014/68/EU⁹⁾ CRN 	<ul style="list-style-type: none"> PED conforming: All EN1092-1 flanges (< DN 600 /<24") – 2014/68/EU⁹⁾ CRN
Others	<ul style="list-style-type: none"> EAC (Russia, Belarus, Kazakhstan) KCC (South Korea) FM Fire Service Approval acc. to class 1044⁸⁾ VdS: Extinguishing systems DN 50 ... 300 	<ul style="list-style-type: none"> EAC (Russia, Belarus, Kazakhstan) CMC/CPA (China)

¹⁾ DN 750, DN 1050 and DN 1100 (30", 42" and 44") not available with EN 1092-1 (PN 10 and PN 16) and AS4087 flanges

²⁾ Type 01 (SORF)

³⁾ DN ≤ 600 type 01 (SORF); DN > 600 type 11

⁴⁾ Compact with transmitter MAG 5000 CT/6000 CT -20 ... +50 °C (-4 ... +122 °F)

⁵⁾ For verification submit Product Variation Request

⁶⁾ Including Annex G

⁷⁾ In remote version with sensor size DN 50 ... DN 300 (2" ... 12")

⁸⁾ For sizes larger than 600 mm (24") in PN 16 PED conformity is available as a cost-added option. The basic unit will carry the LVD (Low Voltage Directive) and EMC approval. All products sold outside of EU and EFTA are excluded from the directive, also products sold into certain market sectors are excluded. These include:

a) Meters used in networks for the supply, distribution and discharge of water.

b) Meters used in pipelines for the conveyance of any fluid from offshore to onshore.

c) Meters used in the extraction of petroleum or gas, including Christmas tree and manifold equipment.

d) Any meter mounted on a ship or mobile offshore platform. For further information on the PED standard and requirements see page 10/15.

⁹⁾ Not for sensors with 300 µm coating.

Flow Measurement

SITRANS F M

Flow sensor MAG 5100 W

3

Selection and Ordering data	Article No.
Sensor SITRANS F M MAG 5100 W	7 ME 6 5 8 0 -
Hastelloy electrodes, carbon steel flanges, Non EU water markets	
➤ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Diameter	
DN 25 (1")	2 D
DN 40 (1½")	2 R
DN 50 (2")	2 Y
DN 65 (2½")	3 F
DN 80 (3")	3 M
DN 100 (4")	3 T
DN 125 (5")	4 B
DN 150 (6")	4 H
DN 200 (8")	4 P
DN 250 (10")	4 V
DN 300 (12")	5 D
DN 350 (14")	5 K
DN 400 (16")	5 R
DN 450 (18")	5 Y
DN 500 (20")	6 F
DN 600 (24")	6 P
DN 700 (28")	6 Y
DN 750 (30")	7 D
DN 800 (32")	7 H
DN 900 (36")	7 M
DN 1000 (40")	7 R
(42")	7 U
(44")	7 V
DN 1200 (48")	8 B
DN 1400 (54")	8 F
DN 1500 (60")	8 K
DN 1600 (66")	8 P
DN 1800 (72")	8 T
DN 2000 (78")	8 Y
Flange norm and pressure rating	
<u>to EN 1092-1</u>	
PN 6 (DN 1400 ... 2000 (54" ... 78")) ¹⁾	A
PN 10 (DN 200 ... 2000 (8" ... 78")) ¹⁾	B
PN 16 (DN 65 ... 600 (2½" ... 24"))	C
PN 16, non-PED (DN 700 ... 2000 (28" ... 78"))	D
PN 40 (DN 25 ... 50 (1" ... 2"))	F
<u>to ANSI B16.5</u>	
class 150 (1" ... 24")	J
<u>to AWWA C-207</u>	
Class D (28" ... 78") ¹⁾	L
<u>to AS 4087</u>	
PN 16 (DN 50 ... 1200 (2" ... 48"))	N
<u>to JIS</u>	
B 2220:2004 K10 (1" ... 24")	R
Flange material and coating	
Carbon steel flanges ASTM A 105, corrosion-resistant coating of category C4-medium	1
Carbon steel flanges ASTM A 105, 300 µm corrosion-resistant coating of category C4-medium	4
Liner material	
Ebonite Hard Rubber	4
Electrode material	
Hastelloy	2

Selection and Ordering data	Article No.
Sensor SITRANS F M MAG 5100 W	7 ME 6 5 8 0 -
Hastelloy electrodes, carbon steel flanges, Non EU water markets	
Transmitter with display	
Sensor for remote transmitter (Order transmitter separately)	A
MAG 6000, Polyamid, 11 ... 30 V DC/11 ... 24V AC	H
MAG 6000, Polyamid, 115 ... 230 V AC	J
MAG 5000, Polyamid, 11 ... 30 V DC/11 ... 24V AC	K
MAG 5000, Polyamid, 115 ... 230 V AC	L
Communication	
No communication, add-on possible	A
HART	B
PROFIBUS PA Profile 3 (only MAG 6000)	F
PROFIBUS DP Profile 3 (only MAG 6000)	G
Modbus RTU/RS 485 (only MAG 6000)	E
FOUNDATION Fieldbus H1 (only MAG 6000)	J
Cable glands/terminal box	
Metric: Polyamide terminal box or MAG 6000 I compact	1
½" NPT: Polyamide terminal box or MAG 6000 I compact	2

¹⁾ DN 1400 to DN 2000 (54" to 78") do not conform to PED or CRN.

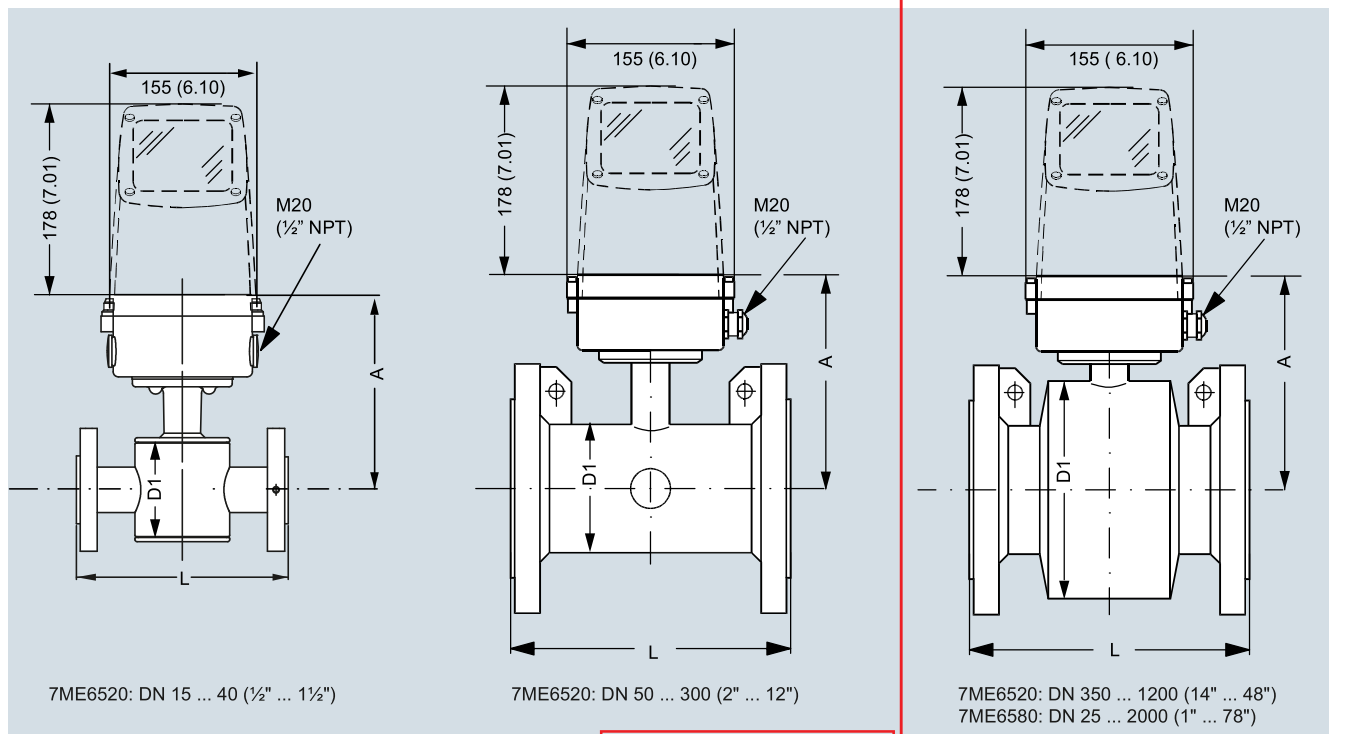
➤ We can offer shorter delivery times for configurations designated with the Quick Ship Symbol ➤. For details see page 10/11 in the appendix.

Flow Measurement

SITRANS F M

Flow sensor MAG 5100 W

Dimensional drawings



7ME6520 NBR or EPDM liner						7ME6580 Ebonite liner					
Nominal size A		D1				A		D1		L ¹⁾	
[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
15	1/2	177	7.0	77	3.0	-	-	-	-	200	7.9
25	1	187	7.4	96	3.8	187	7.4	104	4.09	200	7.9
40	1 1/2	202	8.0	127	5.0	197	7.8	124	4.88	200	7.9
50	2	188	7.4	76	3.0	205	8.1	139	5.47	200	7.9
65	2 1/2	194	7.6	89	3.5	212	8.3	154	6.06	200	7.9
80	3	200	7.9	102	4.0	222	8.7	174	6.85	200	7.9
100	4	207	8.1	114	4.5	242	9.5	214	8.43	250	9.8
125	5	217	8.5	140	5.5	255	10.0	239	9.41	250	9.8
150	6	232	9.1	168	6.6	276	10.9	282	11.1	300	11.8
200	8	257	10.1	219	8.6	304	12.0	338	13.31	350	13.8
250	10	284	11.2	273	10.8	332	13.1	393	15.47	450	17.7
300	12	310	12.2	324	12.8	357	14.1	444	17.48	500	19.7
350	14	382	15.0	451	17.8	362	14.3	451	17.76	550	21.7
400	16	407	16.0	502	19.8	387	15.2	502	19.76	600	23.6
450	18	438	17.2	563	22.2	418	16.5	563	22.16	600	23.6
500	20	463	18.2	614	24.2	443	17.4	614	24.17	600	23.6
600	24	514	20.2	715	28.2	494	19.4	715	28.15	600	23.6
700	28	564	22.2	816	32.1	544	21.4	816	32.13	700	27.6
750	30	591	23.3	869	34.2	571	22.5	869	34.21	750	29.5
800	32	616	24.3	927	36.5	606	23.9	927	36.5	800	31.5
900	36	663	26.1	1032	40.6	653	25.7	1032	40.63	900	35.4
1000	40	714	28.1	1136	44.7	704	27.7	1136	44.72	1000	39.4
	42	714	28.1	1136	44.7	704	27.7	1136	44.72	1000	39.4
	44	765	30.1	1238	48.7	755	29.7	1238	48.74	1100	43.3
1200	48	820	32.3	1348	53.1	810	31.9	1348	53.07	1200	47.2
1400	54	-	-	-	-	925	36.4	1574	65.94	1400	55.1
1500	60	-	-	-	-	972	38.2	1672	65.83	1500	59.1
1600	66	-	-	-	-	1025	40.4	1774	75.39	1600	63
1800	72	-	-	-	-	1123	44.2	1974	77.72	1800	70.9
2000	78	-	-	-	-	1223	48.1	2174	85.59	2000	78.7

¹⁾ Tolerances on built-in length:

DN 15 to DN 200 (1/2" to 8"): +0/-3 mm (+0/-0.12"), DN 250 to DN 400 (10" to 16"): +0/-5 mm (+0/-0.20"),

DN 450 to DN 600 (18" to 24"): +5/-5 mm (+0.20/-0.20"), DN 700 to DN 2000 (28" to 78"): +10/-10 mm (+0.39/-0.39")

- not available



SUBMITTAL

GFXA-HP-SERIESWATER WELL & PRESSURE BOOSTER
EXPANSION TANKS

Models: GFXA-35-HP to GFXA-800L-HP

Submittal Sheet No. C-1007C Rev. 2 1/28/2019

Job Name	_____	Submitted By	_____	Date	_____
Location	_____	Approved By	_____	Date	_____
	_____	Order No.	_____	Date	_____
Engineer	_____	Notes	_____		
Contractor	_____		_____		
Sales Rep.	_____		_____		

Description:

Type GFXA-HP (High Pressure) tanks are ASME replaceable bladder type pre-charged water well & pressure booster expansion tanks for commercial and industrial well and water systems, booster systems, or other potable water applications. They are designed to deliver water under pressure between pump cycles to provide sufficient flow to meet demands. The water is contained in a butyl bladder. All GFXA hydro-pneumatic tanks can be installed vertically or horizontally. Products comply with NSF/ANSI Standard 61.

Construction:

Shell: Carbon Steel
Heads: Carbon Steel
Exterior: Carbocoat 140 - Harvester Red
Bladder: Heavy Duty Butyl
FDA Approved
NSF 61 Listed
System Connection: Epoxy lined

Design Parameters:

Maximum Design Pressure: _____
Temperature Range: -20°F to 240°F

Model Number	Part Number 150 PSI	Part Number 200 PSI	Part Number 250 PSI	Part Number 300 PSI	Tank Volume (Gallons)	Tagging Information	Quantity
GFXA-35-HP					10		
GFXA-50-HP					13		
GFXA-85-HP					23		
GFXA-130-HP					35		
GFXA-200-HP					53		
GFXA-300-HP					79		
GFXA-400-HP					106		
GFXA-500-HP					132		
GFXA-600-HP					158		
GFXA-800L-HP					211		

Typical Specification

Furnish and install, as shown on plans, a _____ gallon _____" diameter X _____" (high) precharged steel water well & pressure booster expansion tank with replaceable heavy-duty butyl bladder. The tank shall have NPT epoxy lined system connections and a 0.3021-32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements, a pressure gauge, and bladder integrity monitor. The tank must be constructed in accordance with most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code. Products comply with NSF/ANSI Standard 61. Each tank shall be model number GFXA-_____-HP or approved equal.



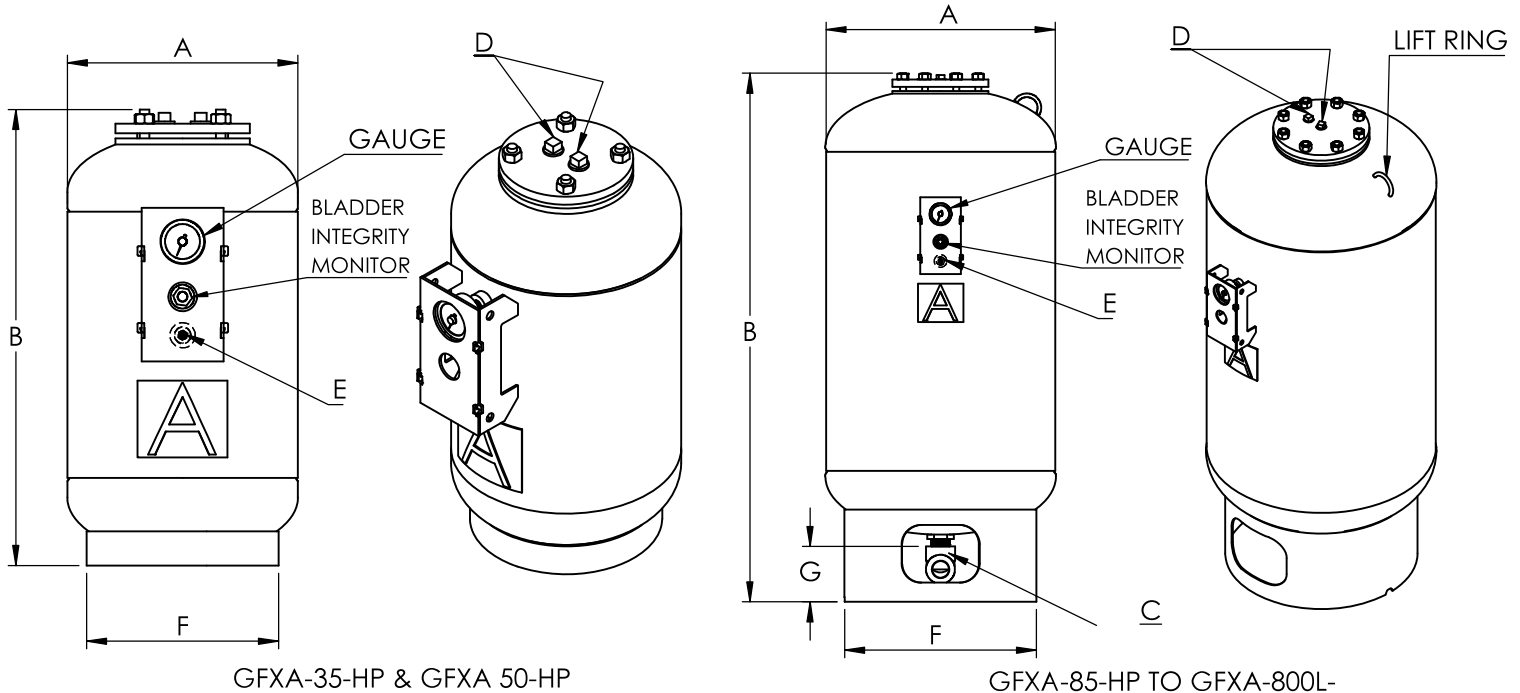
SUBMITTAL

GFXA-HP-SERIES

WATER WELL & PRESSURE BOOSTER
EXPANSION TANKS

Models: GFXA-35-HP to GFXA-800L-HP

Submittal Sheet No. C-1007C Rev. 2 1/28/2019



HP

Dimensions & Weights:

Model Number	Dimensions in Inches						Approx. Shipping Weight (lbs)				
	A	B	System Connection		Charging Valve	F	G	150 PSI	200 PSI	250 PSI	300 PSI
			C	D	E						
GFXA-35-HP	12	23 1/2	-	3/4 NPT	0.302"-32NC	10	-	44	52	53	54
GFXA-50-HP	14	24						47	59	65	73
GFXA-85-HP	16	37	1 NPT			12	5 1/2	86	95	105	122
GFXA-130-HP	20					16		120	127	141	158
GFXA-200-HP	24	43	1 1/2 NPT			20	5 1/4	179	194	220	283
GFXA-300-HP		55						216	252	282	377
GFXA-400-HP	49	280				336		410	501		
GFXA-500-HP	30	57	24			340		400	512	607	
GFXA-600-HP		65				2 NPT		384	419	569	684
GFXA-800L-HP	32	76				28			452	592	711

Notes:

- Tanks are factory pre-charged at 40 psig and field adjustable.
- California code-sight glass is available upon request.
- Both top and bottom connections (C & D) access the bladder.
- Bottom connection C is intended to be used for main water supply connection. Top connection D can be used for auxiliary gauge, pressure switch, etc.
- Mounting clips are available upon request.

Communication interface for **Modbus RTU**

– for automation

The CIM/CIU 200 is a standard interface for data transmission between a Modbus RTU network and a Grundfos pump or controller. It makes data exchange possible between Grundfos pumping systems and a PLC or SCADA system. CIM/CIU 200 can also use the SattCon COMLI protocol.

Extensive amounts of datapoints are available from each product via the CIM/CIU 200. The interface offers uncomplicated system integration with both new and legacy systems, as the Modbus RTU protocol is widely supported by existing control systems and PLCs.

The interface module can be installed as an internal add-on or as a wall-mounted unit where internal connection is not supported. The wall-mounted unit is equipped with a 24-240 VAC/VDC power supply.

In addition to Modbus RTU, interface modules are also available for GENIbus, BACnet, Profibus, PROFINET IO, Modbus TCP, LON, GSM/GPRS (wireless communication) and Grundfos Remote Management.

CIM 200 add-on module

The CIM 200 is an add-on communication module installed internally in 11-22 kW Grundfos E-pumps, MGE model H, Control MPC, Hydro MPC, MAGNA3 or Dedicated Controls, Hydro Multi-B.

CIU 200 wall-mounted/DIN-rail unit

The CIU 200 with internal power supply is for Grundfos products that do not support the add-on module.

Supported products

- > Dry running E-pumps: CRE/CRNE/CRIE, MTRE, CME, TPE Series 1000/2000, NBE/NKE
- > MAGNA/ UPE Circulators * / MAGNA3
- > CUE Motor drive for pumps
- > Wastewater-AUTO^{ADAPT}
- > Multi Pump Controller: Control MPC
- > Boosters: Hydro Multi-E and Hydro MPC and Hydro Multi-B
- > CR Monitor* condition monitoring for CR pumps
- > Dedicated Controls for sewage pumps (separate data sheet)
- > Motor Protector MP 204

* additional add-on GENIbus module required

Advantages at a glance

- > Supports a wide range of Grundfos products
- > Simple configuration of Modbus RTU hardware settings
- > Modular design – prepared for future needs
- > 24-240 VAC/VDC power supply in CIU
- > Modbus diagnostics available
- > Transmission speeds up to 38.4 kbs



Using CIM/CIU with Grundfos products

General CIU 200 data

Supply voltage	24-240 VAC/VDC, -10% / + 15%
Frequency	0 - 60 Hz
Power consumption	Max. 11 W
Cable size	IEC: 0.2 - 4 mm ² , UL: 24-12 AWG
Enclosure class	IP 54, according to IEC 60529
Cable entry	6 x M16 Ø4 - Ø10
Operating temperatures	-20 °C to +45 °C (-4 °F to +113 °F)
Storage temperatures	-20 °C to +60 °C (-4 °F to +140 °F)
Dimensions (H/W/D)	182 x 108 x 82 mm

GENIbus Communication

Protocol	GENIbus
Recommended cable type	Screened, double twisted-pair
Maximum cable length	1200 m/ 4000 ft

Modbus Communication

Protocol	Modbus RTU, COM1
Transceiver	RS-485
Transmission speeds	1.2, 2.4, 4.8, 9.6, 19.2, 38.4 kbits/s
Parity settings	Even or no parity
Modbus Slave address	1 – 247, set via rotary switches

Modbus RTU network



Data points

CIM/CIU 200 Modbus									
s = if sensor installed s* = available with sensor or TPE 2000 ¹ differential or absolute, depends on sensor ² Not standard for Control MPC ³ Not supported for all pump variants G= only for MGE model G H= only for MGE model H									
	MAGNA / UPE	MAGNA3	E-Pumps 0.25-7.5 kW	CUE/E-Pumps 11-22 kW	Multi-E	Hydro MPC/ Control MPC	MP 204	Hydro Multi-B	
Control									
Operating Mode	*	*	*	*	*	*	*	*	*
Setpoint	*	*	*	*	*	*	*	*	*
Control Mode	*	*	*	*	H	*	*	*	*
Relay Control			*	*					
Tank filling control								*	
Status									
Operating Mode Status	*	*	*	*	*	*	*	*	*
Control Mode Status	*	*	*	*	*	*	*	*	*
Feedback	*	*	*	*	*	*	*	*	*
Alarm/warning information	*	*	*	*	*	*	*	*	*
Bearing Service information			H	*				*	*
Tank filling status information								*	
Measured Data									
Power/Energy Consumption	*	*	*	*	*	*	*	*	*
Pressure (Head) ¹	*	*	s*	s*	*	²		s	
Flow	*	*	s*	s*	H+s	²			
Relative Performance	*	*	*	*	*	*		*	
Speed and Frequency	*	*	*	*	*	*		*	
Digital Input/Output			*	*	*	*		*	
Motor Current		*	*	*	*	*		*	
DC Link Voltage	*	*	*	*	*	*		*	
Motor Voltage		*	*	*	*	*		*	
Remote Flow		s	G+s	s	H+s			*	
Inlet Pressure ¹			G+s	s	H+s	s		s	
Remote Pressure ¹		s	G+s	s	H+s	s		s	
Level			s	s	H+s	s		s	
Motor Temperature			G	*	*			s	
Remote Temperature		s	s	s	H+s	s			
Pump Liquid Temperature	*	*	G+s	s					
Bearing Temperatures			H+s	s					
Auxiliary Sensor Input			s	s	H+s				
Operation Time (Run Time)	*	*	*	*	*	*	*	*	*
Total on time	*	*	*	*	*	*	*	*	*
Number Of Starts		*	*	*	*	*	*	*	*
Ambient Temperature			H+s		H+s	s			
Inlet and Outlet Temperatures						s			
Heat energy meter		*	H						
Outlet Pressure ¹			H+s		H+s	²		s	
Feed Tank Level			H+s		H+s	s		s	
Phase Voltages							*	*	*
Line Voltages/Currents/Frequency							*	*	*
Start/Run Capacitor							*	*	*
Voltage Angles + Cos phi							*	*	*
Insulation resistance							*	*	*
Starts/h and auto restarts/24h							*	*	*
Subpump Data (for each sub pump in the system)									
Alarm/Status information					*	*	*	*	*
Operation Time (Run Time)					*	*	*	*	*
Speed					H	*	*	*	*
Line current/ power consumption					H	*	*	*	*
Motor temperature					H	*	*	*	*
Number of starts					H	*	*	*	*
Control pump: force to stop/ auto						*	*	*	*

Note: E-Pumps = CRE/CRNE/CRIE, MTRE, CME, TPE Series 1000/2000, NBE/NKE.
 Note: For WW-AutoAdapt pumps and Dedicated Controls view to related datasheets
 Note: TPE twin pumps in range 3.0 -22 kW needs always 2 CIU modules
 Note: For DDA dosing pumps please view to related datasheets

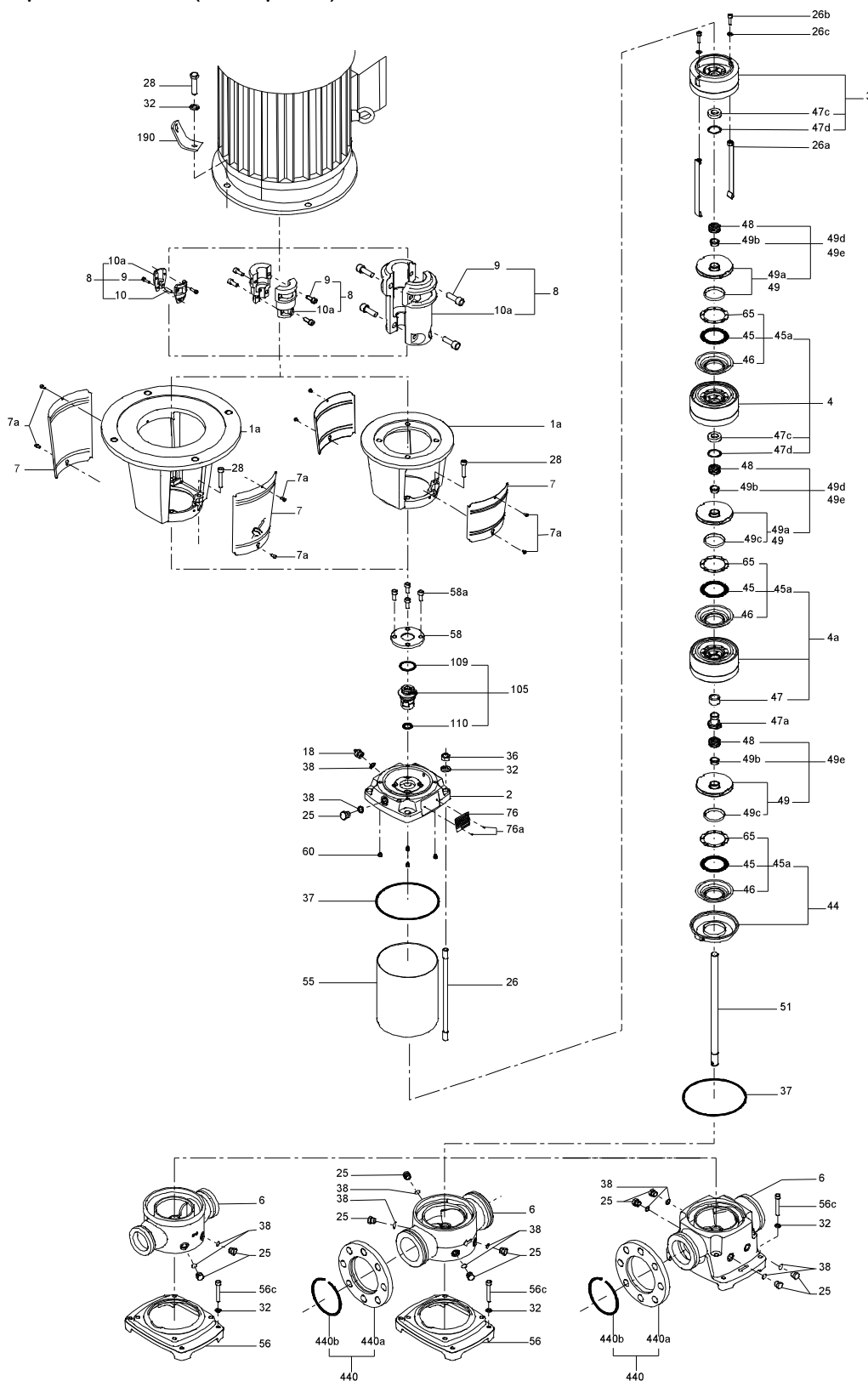
TAB4 - Service Parts - Pumps

TAB 4

Service Parts - Pumps

(tm069487 for LACR model B standard)

Service parts CR 45-3-1 (both options)



Service parts CR 45-3-1, Prod number 96417833
Produced After 1410 (production year and week number)

Position	Description	Annotation	Classification data	Part No.	Count	Unit
- 6	Base			96587694	1	pcs
6	Base				1	
- 80	Kit, chamber stack			96416932	1	pcs
- 80	Chamber stack				1	
- 3	Upper chamber cpl.					
	Guide cup					
	Guide cup					
	Cone					
	Guide vane					
	Chamber					
	Chamber					
47d	Lock ring					
47c	Bush					
- 4a	Intermediate chamber cpl.					
	Guide cup					
	Guide cup					
	Cone					
	Guide vane					
	Chamber					
	Chamber					
45a	Neck ring cpl.					
47	Bearing					
- 4	Intermediate chamber cpl.					
	Guide cup					
	Guide cup					
	Cone					
	Guide vane					
	Chamber					
	Chamber					
45a	Neck ring cpl.					
47d	Lock ring					
47c	Bush					
26c	Washer		Designation: DIN 125A Thickness: 1,6			
26b	Hex socket head cap screw					
26a	Strap cpl.					
- 44	Suction interconnector coupling					
	Suction interconnector					
45	Seal ring					
46	Neck ring					
65	Top f/neck ring					
- 47a	Bearing cpl.					
	Driver					
	Holder					
	Disc spring					
	Bearing ring					
- 49e	Impeller cpl.					
48	Nut					
49b	Split cone					
- 49	Impeller					
	Impeller hub					
49c	Wear ring					
- 49d	Impeller cpl.					

Position	Description	Annotation	Classification data	Part No.	Count	Unit
48	Nut					
49b	Split cone					
- 49a	Impeller, reduced diameter					
	Impeller hub					
49c	Wear ring					
51	Shaft					
-	Kit, chambers			98497485	1	pcs
- 4a	Intermediate chamber cpl.				1	
	Guide cup					
	Guide cup					
	Cone					
	Guide vane					
	Chamber					
	Chamber					
45a	Neck ring cpl.					
47	Bearing					
- 47a	Bearing cpl.				1	
	Driver					
	Holder					
	Disc spring					
	Bearing ring					
-	Kit, coupling			96417004	1	pcs
	Adjusting fork				1	
- 8	Coupling cpl.		Dimension: 22/41,2		1	
9	Hex socket head cap screw		Designation: DIN 912			
			Length: 25			
			Thread: M10			
10a	Coupling half					
9	Hex socket head cap screw		Designation: DIN 912		4	
			Length: 25			
			Thread: M10			
-	Kit, coupling guard			96505135	1	pcs
7a	Socket button head screw				4	
7	Coupling guard				2	
-	Kit, cover			98832448	1	pcs
58a	Hex socket head cap screw		Designation: DIN 912		4	
			Length: 25			
			Thread: M10			
58	Cover				1	
-	Kit, gaskets			96416599	1	pcs
	Adjusting fork				1	
37	O-ring				2	
38	O-ring				2	
38	O-ring				4	
60	Spring				4	
109	O-ring				1	
110	O-ring		Diameter: 21,2		1	
			Material type: EPDM			
			Thickness: 3,55			
-	Kit, impeller			98497488	1	pcs
48	Nut				1	
48	Nut				1	
49b	Split cone				1	
- 49	Impeller				1	
	Impeller hub					
49c	Wear ring					
-	Kit, Impeller, reduced			98634014	1	pcs
48	Nut				1	
48	Nut				1	

Position	Description	Annotation	Classification data	Part No.	Count	Unit
49b	Split cone				1	
- 49a	Impeller, reduced diameter				1	
	Impeller hub					
49c	Wear ring					
-	Kit, plug			99017530	1	pcs
- 25a	Drain plug				2	
25a	Pipe plug					
25	Drain plug					
25	Plug				3	
38	O-ring				6	
38	O-ring		Diameter: 16,3		6	
			Material type: FKM			
			Thickness: 2,4			
-	Kit, shaft seal HQQE			96525458	1	pcs
	Grinding device				1	
- 105	Shaft seal		Material type: HQQE		1	
	Adjusting fork					
109	O-ring					
110	O-ring		Diameter: 21,5			
			Material type: EPDM			
			Thickness: 4,25			
1a	Motor stool			99430476	1	pcs
2	Pump head			96547433	1	pcs
- 3	Upper chamber cpl.			98634042	1	pcs
47c	Bulk, Bush (10 pcs)			99321194	1	
- 4a	Bulk, Intermediate chamber cpl. (5 pcs)			99262867	1	pcs
47	Bulk, Bearing (10 pcs)			99964632	1	
47	Bearing			99928986	1	
+ 4a	Intermediate chamber cpl.			99139113	1	pcs
- 4	Bulk, Intermediate chamber cpl. (5 pcs)			99458546	1	pcs
45a	Bulk, Neck ring cpl. (4 pcs)			98763585	1	
45a	Bulk, Neck ring cpl. (10 pcs)			96547397	1	
7a	Bulk, Socket button head screw (10 pcs)			96549696	4	pcs
7	Bulk, Coupling guard (10 pcs)			96603279	2	pcs
9	Hex socket head cap screw		Designation: DIN 912	99789390	4	pcs
			Length: 25			
			Thread: M10			
+ 18	Bulk, Air vent screw (5 pcs)			96547461	1	pcs
+ 18	Air vent screw			95061351	1	pcs
25	Bulk, Plug (10 pcs)			96536013	1	pcs
26c	Bulk, Washer (4 pcs)		Designation: DIN 125A	99262704	2	pcs
			Thickness: 1,6			
26c	Bulk, Washer (10 pcs)		Designation: DIN 125A	99886930	2	pcs
			Thickness: 1,6			
26b	Bulk, Hex socket head cap screw (10 pcs)			98931380	2	pcs
26a	Strap cpl.			98983869	2	pcs
26	Staybolt		Length: 407	98976712	4	pcs
			Thread: M16			
28	Bulk, Hex socket head cap screw (10 pcs)		Designation: DIN 912	96536147	4	pcs
			Length: 50			
			Thread: M10			
32	Bulk, Washer (100 pcs)		Designation: DIN 125 A	98923051	4	pcs
			Inner diameter: 17			
			Outer diameter: 30			
			Thickness: 3			
36	Bulk, Hex nut (20 pcs)		Thread: M16	96620480	4	pcs
37	Bulk, O-ring (10 pcs)			96536142	1	pcs
38	Bulk, O-ring (10 pcs)			99198815	2	pcs



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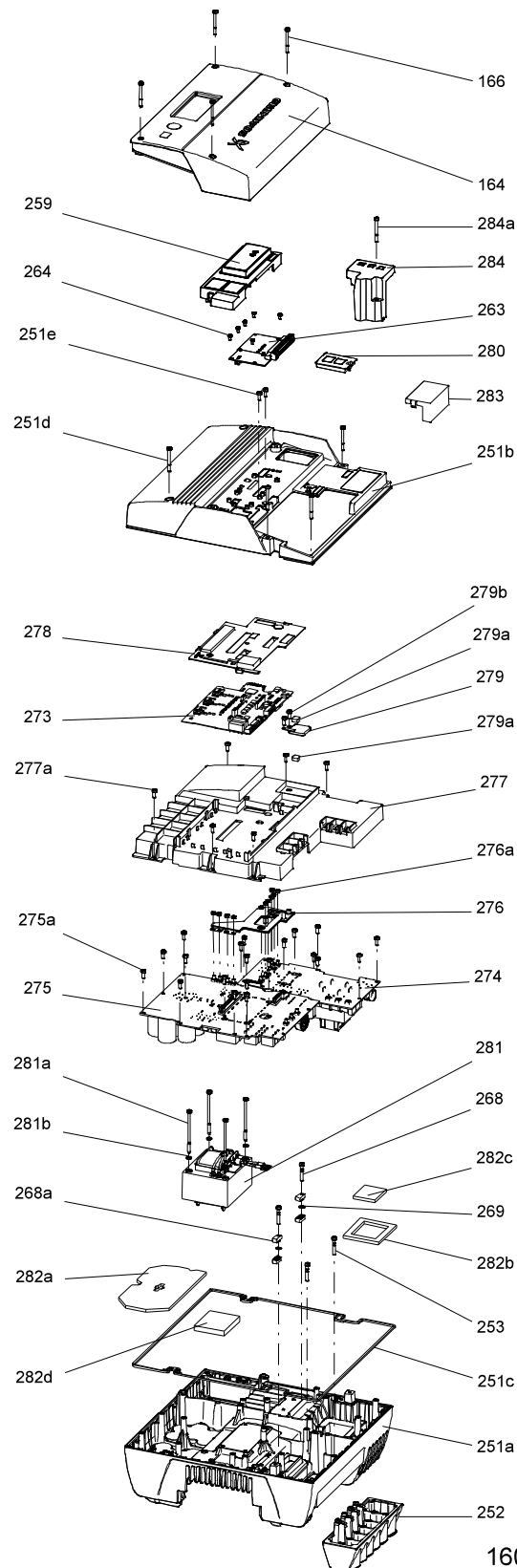
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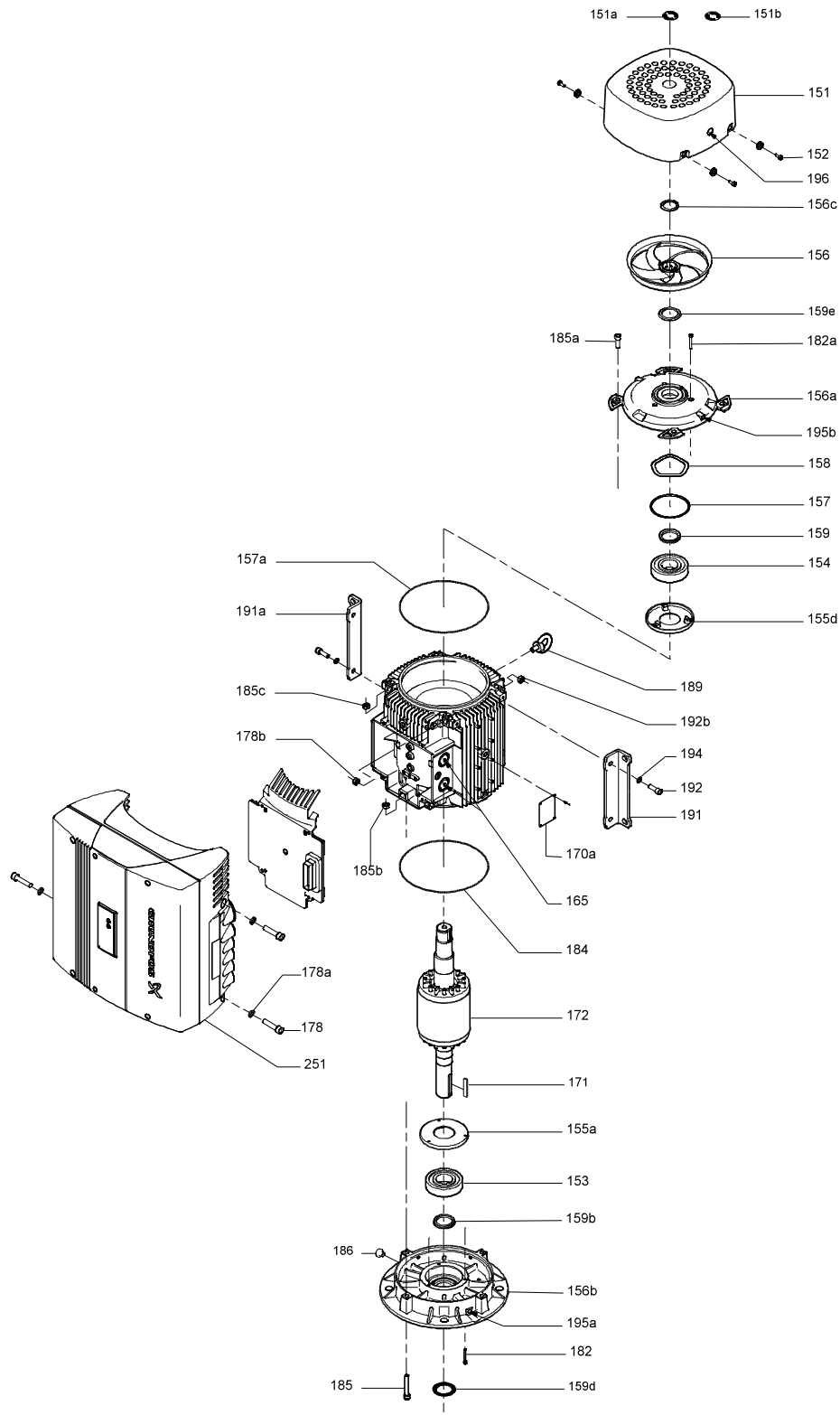
Position	Description	Annotation	Classification data	Part No.	Count	Unit
38	Bulk, O-ring (50 pcs)			99412727	2	pcs
- 44	Suction interconnector coupling			98634054	1	pcs
45	Bulk, Seal ring (10 pcs)			97911448	1	
45	Bulk, Seal ring (10 pcs)			96535952	1	
65	Bulk, Top f/neck ring (10 pcs)			96547390	1	
+ 47a	Bulk, Bearing cpl. (5 pcs)			99270649	1	pcs
+ 47a	Bulk, Bearing cpl. (10 pcs)			96535951	1	pcs
48	Bulk, Nut (3 pcs)			99262680	1	pcs
48	Bulk, Nut (10 pcs)			99262683	1	pcs
48	Bulk, Nut (10 pcs)			96536016	1	pcs
- 49e	Impeller cpl.			98394328	2	pcs
48	Bulk, Nut (3 pcs)			99262680	1	
48	Bulk, Nut (10 pcs)			99262683	1	
48	Bulk, Nut (10 pcs)			96536016	1	
49b	Bulk, Split cone (10 pcs)			96536010	1	
- 49	Bulk, Impeller (10 pcs)			96535946	1	
49c	Bulk, Wear ring (10 pcs)			96535949		
49b	Bulk, Split cone (10 pcs)			96536010	1	pcs
- 49a	Bulk, Impeller, reduced diameter (5 pcs)			96535954	1	pcs
49c	Bulk, Wear ring (10 pcs)			96535949	1	
51	Shaft			98506306	1	pcs
55	Outer sleeve		Outer diameter: 216,0 Length: 263,5	98820341	1	pcs
58	Cover			98893158	1	pcs
60	Bulk, Spring (20 pcs)			96536032	4	pcs
- 105	Bulk, Shaft seal (12 pcs)		Material type: HQQE	96984086	1	pcs
	Adjusting fork			96587896	1	
109	Bulk, O-ring (2 pcs)			99651108	1	
109	Bulk, O-ring (10 pcs)			96547586	1	
+ 105	Bulk, Shaft seal (12 pcs)		Material type: HQQE	96984070	1	pcs
440b	Bulk, Lock ring (4 pcs)			96535943	1	pcs

Exploded view Service parts MLE160AC - Motor-Drive System



160X240

Exploded view



Service parts MLE160AC, Prod number 85901138
Produced After 0825 (production year and week number)

Position	Description	Annotation	Classification data	Part No.	Count	Unit
-	Kit, bearing cpl.			96796812	1	pcs
153	Angular-contact bearing		Designation: 7310B		1	
154	Ball bearing				1	
158	Waved washer				2	
159	V-ring				1	
-	Kit, bearing plate			96796809	1	pcs
155.a	Cover				1	
208a	Gasket				3	
208	Hex socket head cap screw		Designation: DIN912		3	
			Length: 40			
			Thread: M5			
-	Kit, Connector plugs			96348923	1	pcs
	Connector plug 5-pole				1	
	Connector plug 4-pole				1	
	Connector plug 4-pole				1	
	Connector plug 3-pole				1	
	Connector plug 3-pole				1	
	Connector plug 3-pole				1	
	Connector plug 3-pole				1	
	Connector plug				1	
- 273	Kit, control board			96348918	1	pcs
	Service kit instruction				1	
	Controlboard				1	
-	Kit, eyebolt			96796712	1	pcs
189	Eyebolt				2	
-	Kit, fan cover			96830826	1	pcs
151	Fan cover				1	
152.a	Rubber bushing				4	
152	Hex head cap screw				4	
196	Diaphragm				1	
-	Kit, flange			96831195	1	pcs
	Flange				1	
159.b	Seal ring				1	
185.b	Nut				4	
185	Hex socket head cap screw				4	
186	Drain plug				4	
195.a	Grease nipple				1	
-	Kit, funct. module - adv. I/O			96348936	1	pcs
263	Add-on module, cpl. w/plugs				1	
-	Kit, Function module - Geni/RS485			96348932	1	pcs
263	Add-on module, cpl. w/plugs				1	
-	Kit, gaskets			96798508	1	pcs
184	O-ring		Diameter: 235		2	
275	Kit, inverter board			96348920	1	pcs
-	Kit, lubrication nipple			96796671	1	pcs
195.b	Grease nipple				2	
195.a	Grease nipple				1	
-	Kit, ND-end shield cpl.			96796810	1	pcs
156a	End shield NDE				1	
158	Waved washer				1	
159	V-ring				1	
185.c	Nut				4	
185.a	Hex socket head cap screw				4	



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Position	Description	Annotation	Classification data	Part No.	Count	Unit
195.b	Grease nipple				1	
-	Kit, operating panel			96348924	1	pcs
259	Operation panel				1	
274	Kit, rectifier board			96348921	1	pcs
-	Kit, terminal box			96348914	1	pcs
164	Cover cpl.				1	
166	Pan head thread forming screw				5	
251	Terminal box				1	
277	Blind cover				1	
283	Motor cover cpl.				1	
284	Cover				1	
-	Kit, varistor			96348917	1	pcs
279.b	Pan head thread forming screw				2	
279	Varistor				1	

TAB5 - Manuals

TAB 5

Manuals

CRE, CRIE, CRNE, SPKE, CRKE, MTRE

Grundfos E-pumps with MLE frequency-controlled, asynchronous motors

Installation and operating instructions

CRE45-3-1 Pumps on the HydroMPC-E System Primary Option



English (US) Installation and operating instructions

Original installation and operating instructions

These installation and operating instructions describe Grundfos CRE, CRIE, CRNE, CRKE, SPKE, MTRE.

Sections 1-4 give the information necessary to be able to unpack, install and start up the product in a safe way.

Sections 5-11 give important information about the product, as well as information on service, fault finding and disposal of the product.

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Read this document before installing the product. Installation and operation must comply with local regulations and accepted codes of good practice

1. Limited warranty

Products manufactured by Grundfos Pumps Corporation (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges that may arise in connection with a warranty claim.

Products which are sold, but not manufactured by Grundfos, are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty.

Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions and accepted codes of good practice. The warranty does not cover normal wear and tear.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date and supporting installation data.

Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

Grundfos will not be liable for any incidental or consequential damages, losses, or expenses arising from installation, use, or any other causes. There are no express or implied warranties, including merchantability or fitness for a particular purpose, which extend beyond those warranties described or referred to above. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Products which are repaired or replaced by Grundfos or authorized service center under the provisions of these limited warranty terms will continue to be covered by Grundfos warranty only through the remainder of the original warranty period set forth by the original purchase date.